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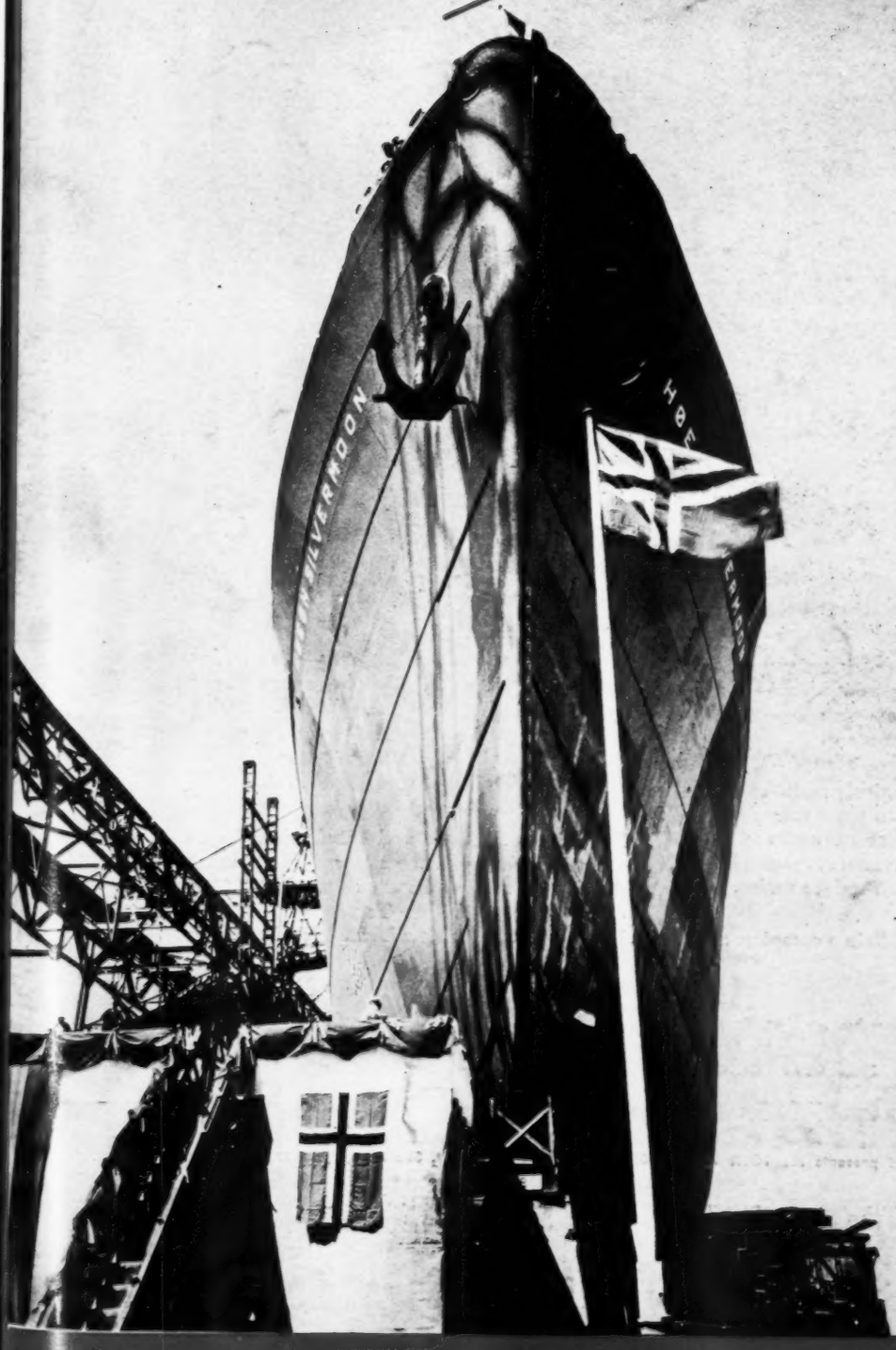

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DIESEL and GAS ENGINE PROGRESS

N INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

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FRONT COVER ILLUSTRATION: Launching of the Motor Cargo Vessel "Hoegh Silvermoon," length 415 ft., beam 56 ft., gross tonnage 5300. Built by Burmeister & Wain's and powered with its direct reversible, single acting, 2-cycle, 9-cylinder Diesel of 6300 I.H.P. corresponding to approximately 5100 B.H.P. at 140 rpm.

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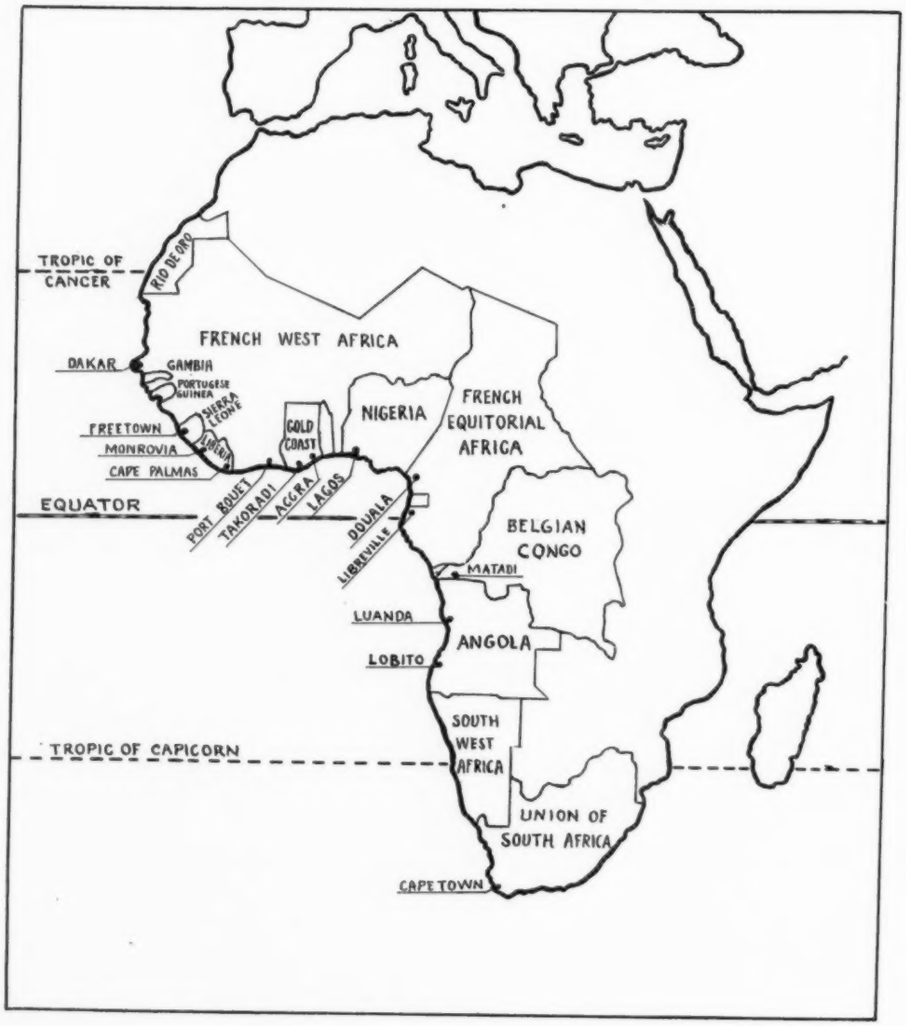
DIESEL SHIPS in South African Trade

By R. EARLE ANDERSON*

Outline map of Africa showing principal ports visited by ships of the American South African lines.



DIESEL powered ships, originally built as part of the war effort, are being utilized by far-sighted American shipping companies to develop our foreign trade in an area of the world that gives promise of vying with the Dutch East Indies in the ultimate production of commodities peculiar to the torrid zone.

This area, the West Coast of Africa, has, until recently, received little attention from American commercial and shipping interests. Very largely, in fact almost entirely, it has been an area of European colonial development and exploitation. Historically, it includes such intriguing coastal fringes as the "Ivory Coast," the "Gold Coast," the "Grain Coast" and the "Slave Coast," terms which today are names only; for the slave trade is gone almost past memory, the ivory is exhausted and largely superseded by modern plastics, and the gold has been overshadowed by the great mines of the precious metal in South Africa.

With the exception of the little, but important republic of Liberia, this whole area, extending from Dakar on the north, the strategically located port of French West Africa, to the Portuguese colony of Angola on the south, is under the political and commercial control of Europe, and even Liberia has been dominated by the financial power of London, Brussels and Amsterdam. England, of course, with her colonies of Sierra Leone, Nigeria and what is still officially known as the Gold Coast, ranks first among the parent powers. But France, with its vast holdings of French West Africa and French Equitorial Africa, Portugal with its colony of Angola, and Belgium, suzerain of the "Darkest Africa" known as the Belgian Congo, rule over an area, the undeveloped natural wealth of which can only be guessed at.

American trade with this coast has, of late years, been growing, despite the fact that commercial dealings with the colonials are largely cartel controlled, with very little by way of a welcome extended to American business, and despite the fact that such trade as did exist with the United States has been, until recently, dependent on British, Belgian, Dutch and Norwegian shipping. Now, all that is due for a change. Two of our leading shipping companies are establishing regular and frequent service under the American flag, the one from New York and the outports of the North Atlantic; the other from New Orleans and the seaports of the Gulf; and both will cover the entire range from Dakar to Lobito.

---

* *Formerly Director of Finance, U. S. Maritime Commission.*

Cargo ship "Del Oro" of the Delta Line operates between Gulf Ports and the west coast of Africa. She is equipped with Nordberg Diesels.

Already the Belgian Congo looks to the United States as its leading customer, accounting for something like sixty per cent of its commerce; imports and exports. Liberia, strange progeny of the early days of our own country when slavery was our leading problem, is the scene of a major undertaking by one of America's great rubber companies. There, Firestone is establishing plantations for the production of latex, a move the importance of which is realized when we look back to the manipulation of the East Indian rubber market that made so difficult the adequate stock-piling in America of this strategic material when World War II was almost upon us.

Rubber is not the only strategic item produced by the West African area, growing in relative importance though it is. For here is one of our leading sources of manganese and of manganese ore. Tin, also, which is becoming almost a precious metal, figures in our list, while the Belgian Congo is looked to as the leading producer of radium-bearing minerals. The development of atomic power, with its vast possibilities for both good and evil, brings the African Coast into the limelight as a source of uranium. So important to our national defense are these strategic materials that, to provide against transportation difficulties, our own Government, under Lend-Lease, has built an American harbor, costing something over fifteen million dollars, at the Liberian port of Monrovia, a facility that will be of great peacetime aid to American commerce with the entire African West Coast. But there are other products of the area, not classed as strategic, that figure importantly in our trade, and that hold great possibilities for development. First among these is palm oil. Our new American ships will be specially equipped for the carrying of this commodity.

Mahogany logs, many of them of vast size, weighing sometimes as much as ten tons apiece, are also among our imports, as well as other hard woods of importance to the cabinet maker and to our furniture factories, and produced only in the tropics. Then there is cocoa. The United States is the world's greatest consumer of cocoa, which comes to our food and candy factories from tropical countries in various parts of the world. But American business has had little part in determining the conditions governing the production of cocoa, and even less in assuring to itself fair treatment in the cocoa market. The business of raising the cocoa bean in Africa, and of marketing the African crop, is largely cartel-controlled from London, Amsterdam and Geneva. The situation is ripe for the application of constructive American effort.

All these facts point to the importance, from the standpoint of American commerce and American prosperity, of what is being done with such boldness and foresighted imagination by American shipping companies.

One of these, the American South African Line, long a successful operator on the trade route to Capetown, will employ, for the ocean passage, vessels of the Maritime Commission's standard C-2 type, with sailings from New York and the North-Atlantic outports every three weeks. The ships assigned to this use, built by the Moore Dry Dock Company at Oakland, California, have a deadweight capacity of 8630 tons each, are 459 feet, 6 inches in length, draw 25 feet, 9 inches loaded, and are driven at a speed of 15½ knots or better by General Electric steam turbines developing 6000 shaft-horsepower through double reduction gears, with steam supplied by Foster-Wheeler boilers. These ships have special deep tanks with heating coils for palm oil, other deep tanks for latex, are fitted with 4000 cubic feet of refrigerated cargo space, and carry twelve passengers each, in comfortable modern staterooms with private baths.

The plan of operation of this line includes a development new to American foreign-trade shipping, and it is here that the Diesel engine is to play a leading part. For combined with the C-2 service for the crossing will be a feeder service of light-draft Diesel-propelled vessels trading up and down the West African Coast, entering harbors inaccessible to large vessels, and concentrating at a few ports the goods for carriage to the United States, as well as distributing American exports to their African consumers.

For this purpose the company has purchased and is reconditioning three light-draft coastal freight ships that were originally built for the Army and known as FS's. These, with a number of converted LCT's (Landing Craft, Tank), will be based partly on Monrovia and partly on Lagos. The first of these FS's, towing three LST's will reach Monrovia late this year.

The FS's have each a deadweight capacity of 500 tons. They are unusually handy vessels, very complete in their appointments both for cargo and passengers, and are really ocean-going freighters on a small scale, having even such modern equipment as radar. Their hatches are served by two 2-ton cargo booms and one of 20 tons capacity. They draw about 8 feet light and 11 feet loaded, and are powered by two 400 horsepower Cooper-Bessemer Diesel engines, direct connected and with direct reversing, driving twin screws. There are two main generators of 100 kw. each, driven by 3 cylinder Cleveland (G.M.) Diesel engines, while emergency power is provided by a 25 kw., 4 cylinder Superior Diesel set. The first of these FS's will be known as the African Guide. It will have accommodations for five first-class passengers in two staterooms with three and two berths respectively and with connecting bath, while six second-class passengers will be berthed in each of two rooms, also with ample toilet and bath facilities.

The LCT's have been rebuilt for commercial use. Their ramps have been welded up to form spoon bows, bulwarks have been made continuous, and cargo hatches have been added, specially designed so as to take large portable tanks for latex. These boats, which as reconditioned are properly described as self-propelled barges, are each 108 feet long, carry 250 tons of cargo on 4 feet draft, and are driven by triple screws and three 165 hp. Gray marine Diesels built by the Detroit Diesel Division of General Motors. The three engines have independent pilot-house control. There is a 10 kw. Hercules Diesel generator for emergency power and for charging storage batteries.

Three of the C2 ships, the African Glen, African Grove and African Glade, are already in service on the route and these are being supplemented by other ships temporarily assigned until additional C2's are added. The first group of the feeder fleet will be heading for Africa about as this magazine reaches its readers. The others will follow soon.

From the Gulf ports the Delta Line, which is the houseflag name of the Mississippi Shipping Company of New Orleans, has established the other of these trade-building American-flag services to the African West Coast, with three standard C-1-A shelter-deck single screw Diesel cargo vessels, the Del Rio, Del Sol and Del Oro, originally built for the Maritime Commission by the Pennsylvania Shipyards of Beaumont, Texas, a yard that has specialized in the construction of Diesel-propelled ships.

The Delta Liners will call, on the outward voyage, at the South-American ports of Para and Pernambuco, and will then proceed to Takoradi, Accra, Lagos, Douala, Libreville, Matadi, Louando, Lobito, Port Bouet, Monrovia, Freetown and Dakar.

These C-1-A vessels are 412 feet long, with a beam of 60 feet and draw, loaded, 23 feet 6 inches. They have a deadweight capacity of 7229 tons and a speed of 14 knots. Both the officer's and crew's quarters and the accommodations for 12 passengers are air-conditioned. Deep tanks for the carrying of oil cargo have been installed, and dehumidification of cargo holds will safeguard against losses from moisture that are often experienced in the tropical freight services.

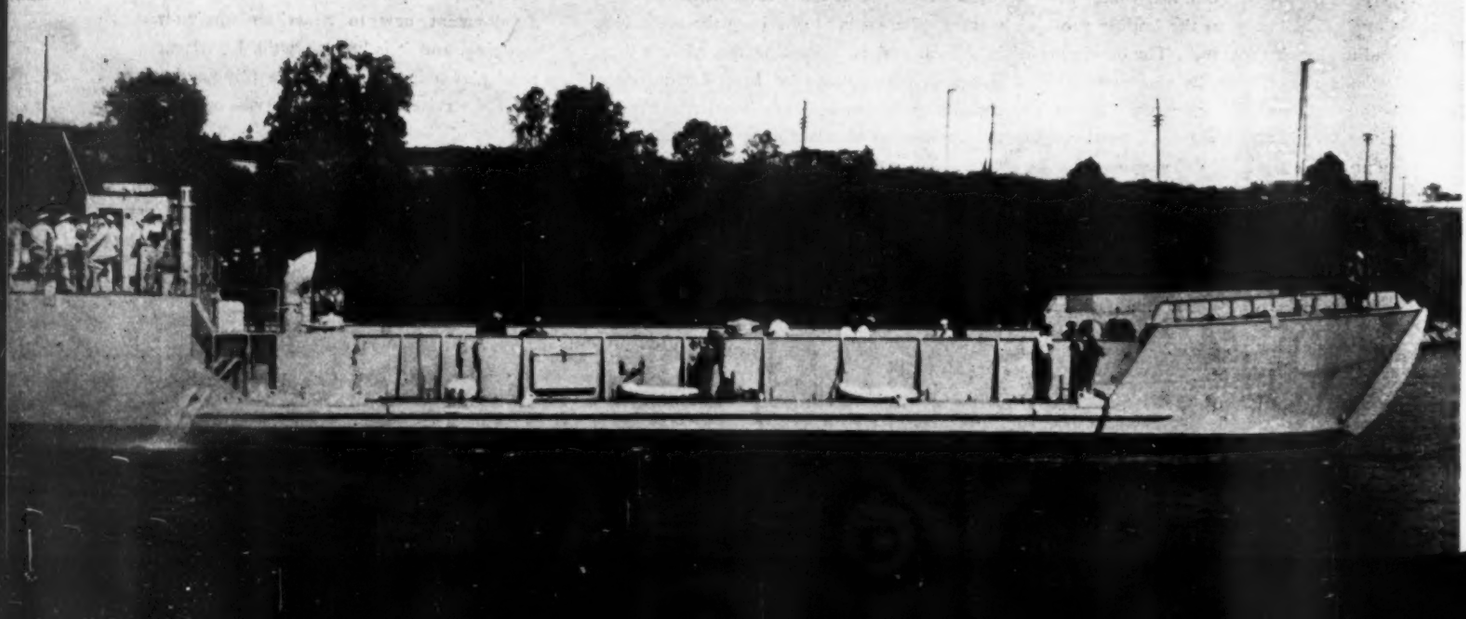
Each of these Delta Line ships is propelled by two Nordberg Diesel engines which, at 220 rpm. produce 2075 normal rated bhp. apiece, and drive a single propeller shaft through flexible couplings and a reduction gear, delivering 4000 shaft horsepower at the propeller. Engine controls, gauge board and ship's telegraph are grouped at the central control station from which the engines are started, stopped, reversed and regulated by a single lever for both engines or by a separate lever for each engine as desired, thus permitting of unusual maneuverability under all operating conditions.

Steam men have sometimes taken unkindly to the marine Diesel because of its being hard to start and stop, but this is not true of the modern Diesel-driven motor ship, which, with controls such as those installed in these C-1-A's, can be maneuvered with the utmost facility, largely eliminating the need for tow-boat services, a characteristic of especial importance in ships serving ports where harbor facilities are not always all that might be desired.

While the more or less exotic materials that come to us from the African Coast, palm oil, cocoa, rubber, mahogany, manganese, uranium, appeal to the imagination and are significant both strategically and commercially, this out-of-the-way portion of the globe may quite possibly develop real importance in absorbing the products of American industry.

It is inevitable that as civilization advances from the fringe along the sea and pushes inland toward the natural wealth of the interior, the need for road-building and for agricultural machinery, for motor vehicles and motor fuels and

A number of these LCT's have been purchased by the American South African Lines for river operation. They are powered by Grey Diesels and are 108 ft. overall.



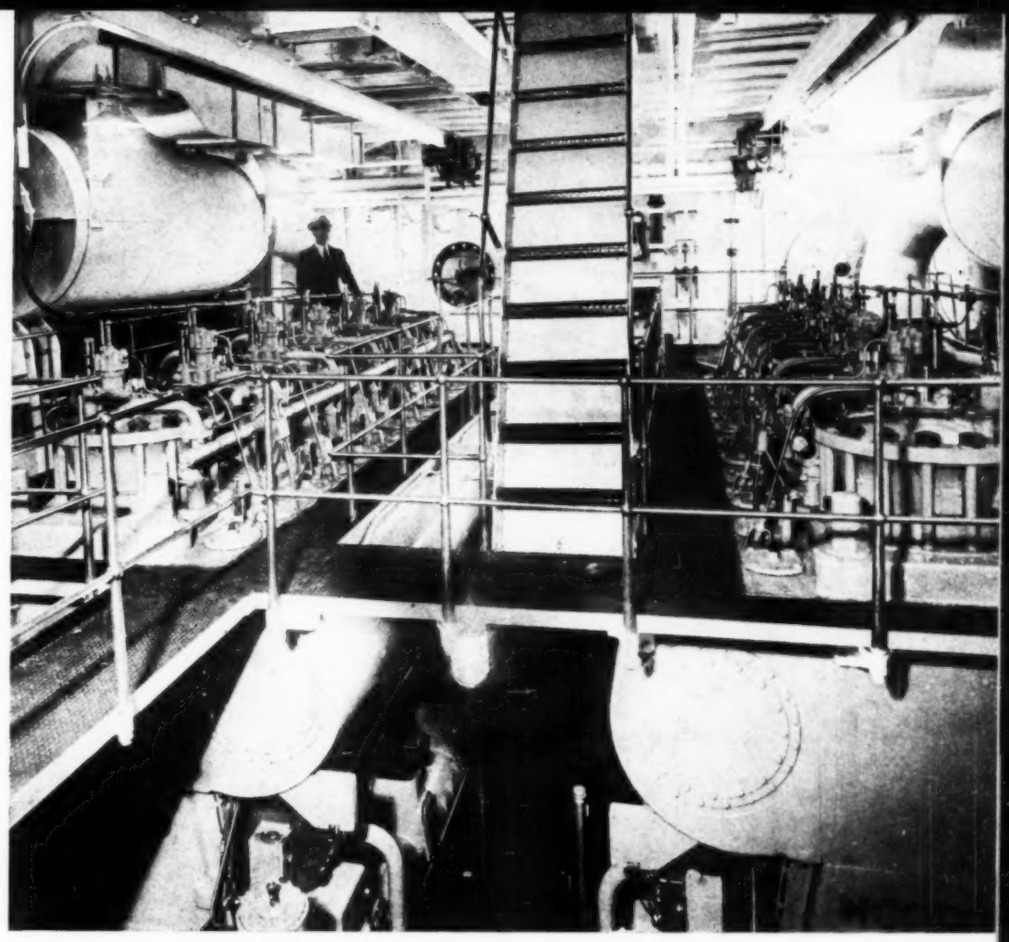
lubricants, for manufactured food-stuffs, textiles, and in fact for the lengthy catalog of goods that are indispensable to modern life and to modern commerce, will increase, and perhaps increase rapidly. That has been the experience in the building-up of our South American trade, where the establishment of adequate shipping services under the American flag has helped in the building up of industries that have consumed American products, increasing both American imports and American exports.

The colonial powers that govern the African coastal territory are alive to the situation, and to the great changes that are possible in this part of the world where modern science, conquering the dreaded tropical diseases that have balked the advance of civilization, has laid the foundation for the beginning of a new era. Officials of the British Colonial Office are hard at work with the colonial administrations in Paris and Brussels, and have arranged for a series of technical conferences extending to 1950, on agriculture and soil conservation, rural economy, forestry, nutrition, labor, education and health, and for the extension of existing rather meagre railway facilities and the building of coastal inter-colony highways, for the improvement of telephone and postal communications and for better transport generally. Meanwhile the special problems of rinderpest, sleeping sickness, and the tsetse fly are being solved, and it is of significance that our own Firestone people seem to have had complete success in elimination of tropical diseases.

All the evidence points toward the dawn of a new day in West Africa. What the future will bring forth only time will tell; time, and the annals, yet to be written, of the achievements of men of vision.

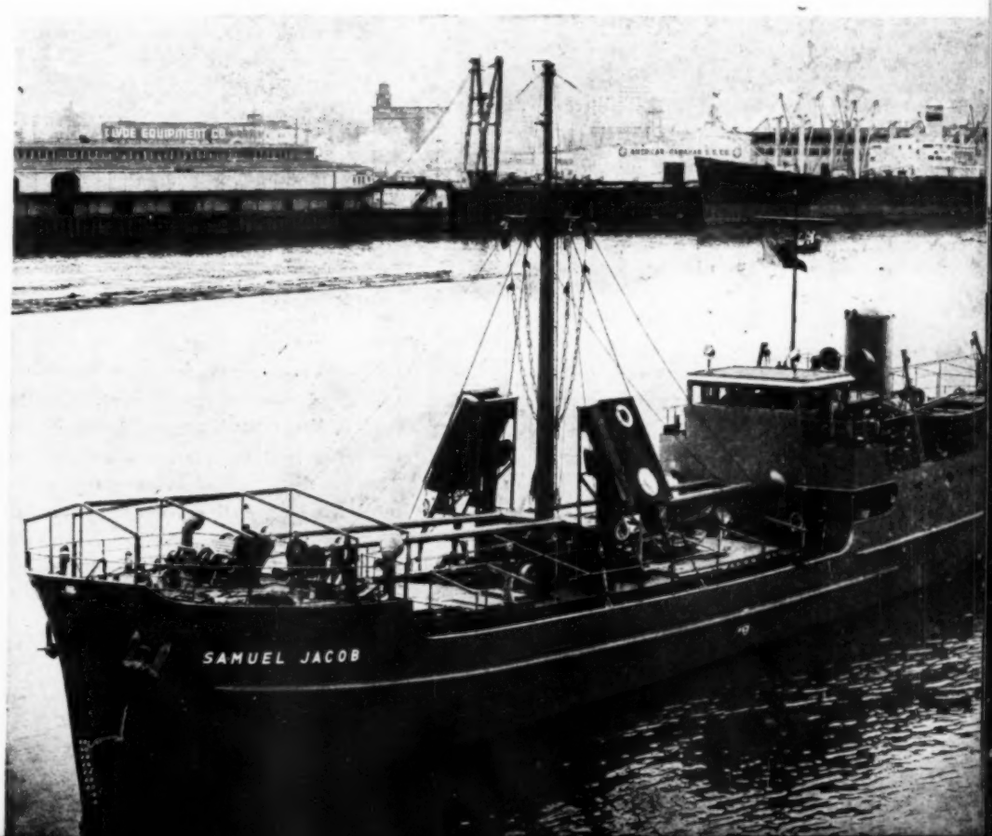
It is therefore particularly fortunate and timely that bold and far-sighted American commercial and transportation interests are pushing forward on this new frontier of American foreign trade, and are putting into constructive peacetime use ships of our war-built Merchant Marine.

The importance of this departure in the development of American shipping should not be underestimated for it means that our own merchant fleets are beginning to make us self sufficient in raw materials now so scarce, and furthermore will develop markets for American goods which soon will be needed to sustain our highly productive domestic economy at top levels.



Engine room view of Diesel ship "Del Oro" showing Nordberg engines which develop 2075 bhp each.

Army coastal freighter similar to FS type purchased by American-South African Line for use in shoal water African harbors.



RECOVERY

By WILL H. FULLERTON

Outlet side of pumping station. This water is a tributary of Bayou Folse.

Corn grows tall on this ground reclaimed by drainage operated by Diesel-engined pumps. At left, E. T. Brady, General Motors Diesel dealer and originator of the marine gear drive for industrial purposes.

A GLANCE at a large-scale map of the southern part of Louisiana will disclose a bewildering network of bayous and lakes criss-crossing a vast expanse of lowlands, some of them wooded in spots, some of them covered only with marsh grass. Some of this territory is generally above the water line, while much of it is submerged at every occasion of high tide or storm. And down in under the grass is rich black land, costly to develop but profitable in the long run if the developers are thorough.

Near Raceland, La., roughly about forty miles southwest of New Orleans, there were thousands of acres of land, flat and level, and useless for cultivation as it was flooded by the overflow from Bayou Folse every time the tide was high. Far enough from the Gulf so that the water was not salty, the land was rich and black and tempting in the extreme. When one speaks of "high tide" in South Louisiana it does not necessarily imply salt water. This land is so flat that the water backs up in the bayous for miles and miles under pressure of the salt water at the shoreline; lowlands thirty or forty miles from the Gulf may be inundated regularly, but the percentage of salt is not worth mentioning and is not harmful to vegetation or land.

Forty-odd years ago, before high income taxes took the fun out of development, these thousands of acres of lowlands near Raceland caught the eye of Northern promoters and capitalists. They acquired the land and went to work with it. A levee was built around the entire holding; the bayou was straightened somewhat, along with its tributary bayous. Drainage ditches—ample in width and depth—were dug throughout and pumping stations constructed. Levees were built also along the bayou banks.

Then the pumping began. The lowlands drained into the big ditches; from these the water was pumped up into the bayou, its level several feet higher than the adjacent land.

The scheme worked. No doubt the land was hard to sell at the start, but people moved in regardless, a few at first, then more and more as the proposition proved itself, and today there is no vacant land to speak of in the Raceland Drainage District. The original promoters are out of the picture; the parish (county to you) has taken over road construction and maintenance and good shell roads serve the farmers. Officials of the District maintain the pumping system, buying supplies, equipment and paying for mechanics and other necessary labor, charging the landholders $3.50 per acre per year for pumping and drainage service. The farms are small, most of them twenty to forty acres, but the soil is extremely productive and this drainage tax can be easily met. "These folks are well off," stated one observer; "they raise good crops and if they have to have a few thousand dollars any time, they seem to be able to dig it up without any difficulty." As a sample of the black ground's productivity, two crops of corn per year are grown—and without a bit of fertilizer; and this has been going on in some spots in the District now for over forty years.

Four pumping stations are maintained. Pumping is not constant; sometimes days or even a few weeks may go by without the need of starting the pumps. However, in time of rain or heavy tides, it may be necessary to operate the pumps for days—or weeks—without stopping. These drainage ditches must be kept clear for water from the fields.

Pumps are 24 in. size, capable of handling a big volume of water. A Diesel is used for every pump; the ones put in twenty or more years ago were of the one-cylinder type, with two huge flywheels, putting out around fifty horsepower at an engine weight of four tons, and those engines cost plenty of money, too. They were good engines (De La Vergne) and throughout the years have done an excellent job in keeping water off the land and building pros-

OF LOUISIANA BAYOU FARMLAND

perity for hundreds of small landholders, but no engine lasts forever.

Recently it has been necessary to replace a couple of these power plants. Some little time ago, one was replaced with a lightweight, high-speed Diesel, using a V-belt to obtain the necessary reduction.

Then about six months ago, another of the old heavy-duty machines had to give way to time. And for the installation of the new job, the Drainage District management gave ear to E. T. Brady, dealer in the nearby city of Houma, La., for General Motors Diesels. And Mr. Brady had ideas.

He is no newcomer to the power field. For nearly a score of years, he was a sales engineer for a prominent tool and machinery house; later he operated his own shops. What they missed teaching him in school, he found out in another good school—that of experience. And Brady told the drainage board that he could install a radiator-equipped industrial type General Motors Diesel, fitted with the new G-M hydraulically operated marine reverse and reduction gear. The engine would be direct connected to the pump, getting its reduction through the gear, and the installation expense would be practically nil.

Some of them laughed at him. Others just wondered. Still others said, "Let's leave it to Brady; if he says it will work, then it will." And there it is. The engine, a 3-cylinder Series 71 General Motors Diesel, rated 83 hp. at 1850, is direct connected to one of the 24 in. pumps. The reduction gear ratio is 4.5:1. A simple bed was placed on top of the huge mass of concrete supporting the old engine and according to Brady, his installation expense was less than twenty dollars. This is the first time, they say, that the new hydraulic gear has been used in this fashion, and Brady's scheme is a practical addition to the G-M industrial installation engineering.

As for operation, the first run-in trial was for forty-seven hours straight operation. No trouble at all developed. Since then, the outfit on several occasions has performed for over a week constantly; still no trouble. The engine is a straight factory production line machine; no special equipment added; fuel and lube filters are AC, injection is the G-M system; cooling is by the G-M industrial-type radiator. It's easy to start, easy to service, and "just runs itself," according to the pumping station attendants. The drainage board is now fully convinced that their neighbor, Mr. Brady, knows something about engine installation.

Another G-M, same size, has just been installed in place of the high-speed engine with the V-belt drive; this job had not given complete satisfaction and the board decided to let Brady replace it.

This engine is not equipped with the marine gear. As long as the V-belt reduction had been put in place and was itself operating well enough, the G-M Diesel was connected to this drive. "This drive itself, plus its installation," says Mr. Brady, "had cost the drainage board $1800. If we install any more G-M Diesels, they will be put in with the marine gear and that installation charge of $1800 will be saved."

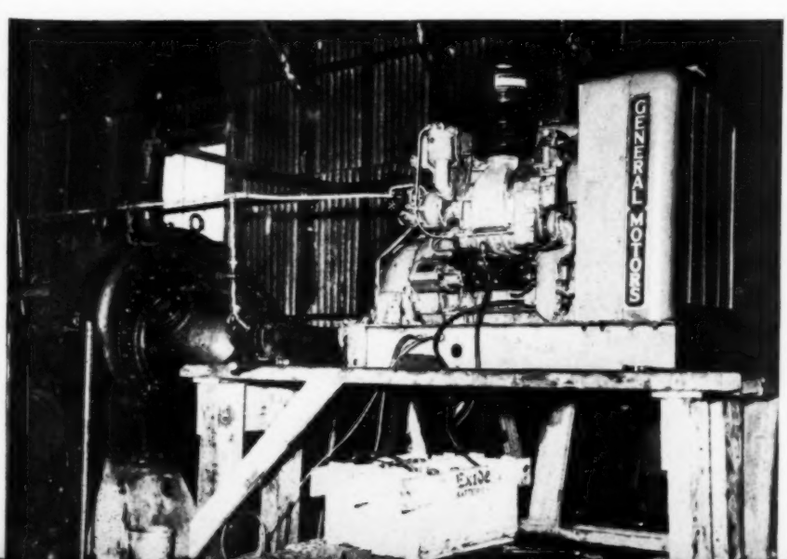
This second G-M engine has been put through its run-in trials and has also been operated steadily during long rains. Its operation is just as satisfactory as that of the first one, according to the drainage engineers.

One interesting point, testifying to advances in Diesel engineering, is that the weight of the original one-cylinder 50 hp. engines, 8,000 lbs., is over four times the weight of the new General Motors machines, doing the same job at lower initial cost and lower maintenance and parts cost.

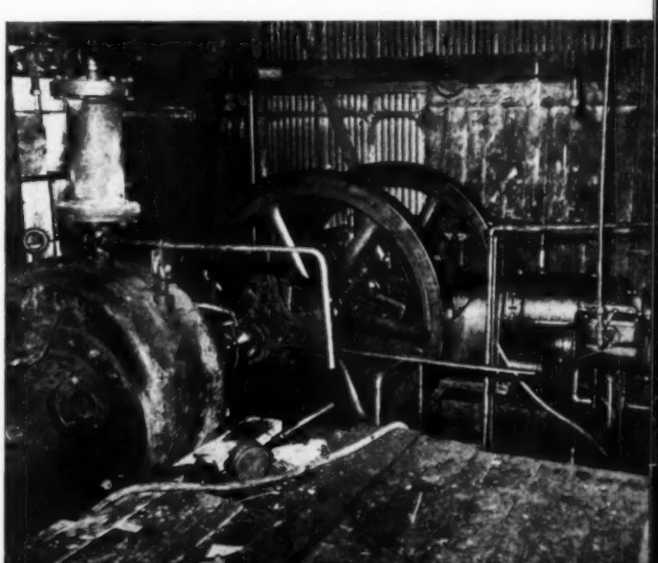
The only question is how long that marine reduction gear will hold up. Brady has an answer for that one, too. Says he,

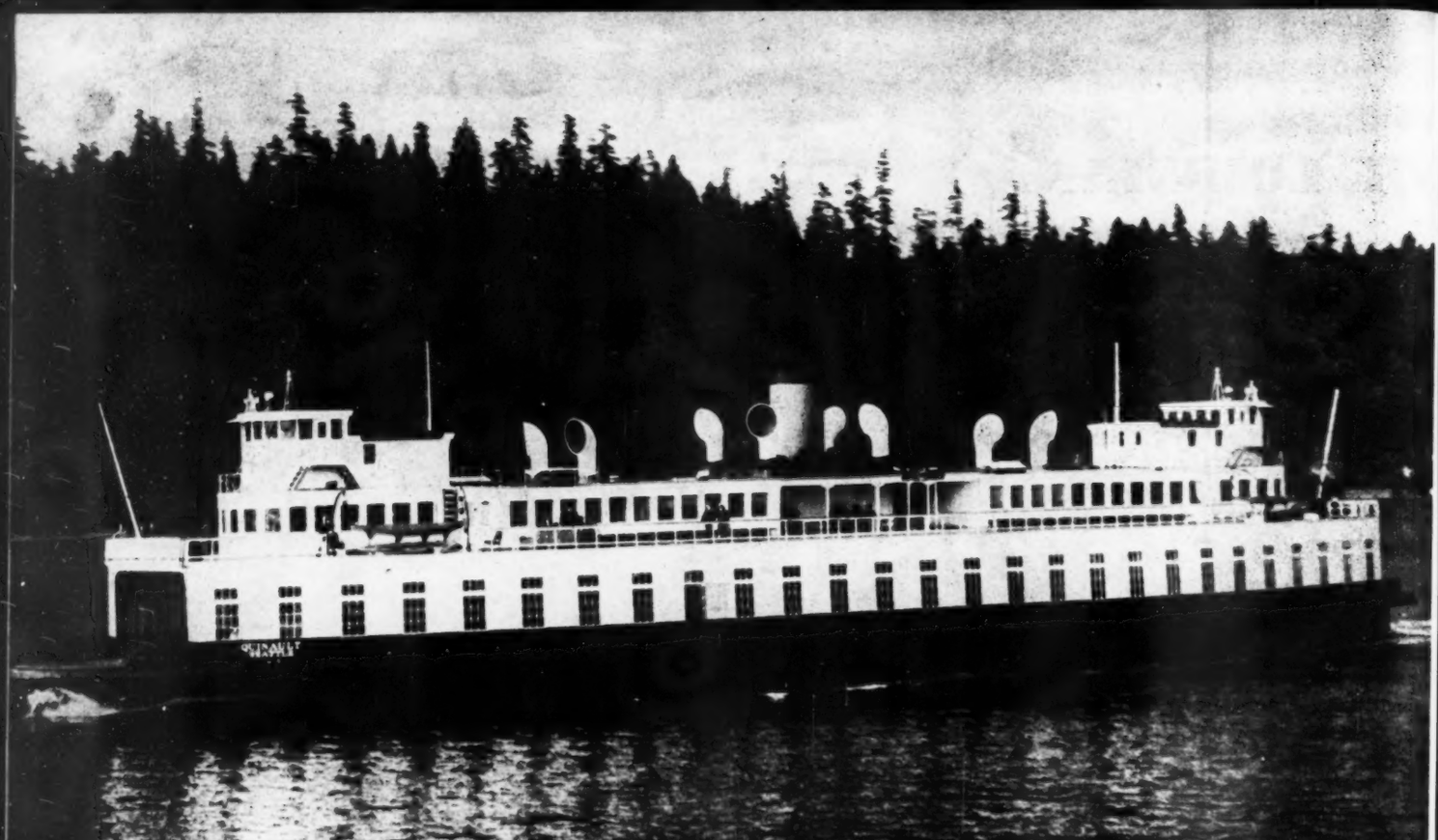
"People unfamiliar with gears just do not understand them. They do not appreciate the fact that in many fishing boats the same gear has been in use for years, and that in every ocean liner driven by steam turbines, a reduction gear turns the propeller. There has been just as much improvement in gear material and construction as in engine engineering, and there's absolutely no question that today's gears are here to stay and represent economy in power application."

View of the 3-cylinder General Motors Diesel connected through General Motors marine-type hydraulically operated reverse & reduction gear, ratio 4.5:1. No flexible couplings nor universals used; engine is lined up as rigidly as a marine engine in a boat. And it works.



One of the original 1-cylinder, 50 hp. engines. Note the simple clutch and long control handle, also the 24" Worthington pump. This type of installation has delivered many years of profitable service.





Repowered ferry "Quinault", owned by the Puget Sound Navigation Company, boasts a 2.5 knot increase in speed with new General Motors Diesels.

"Quinault" comes in to slip. She and three sister ships each have seven lanes available for automobiles. They are 251x46 feet at the waterline and have a displacement of 1025 tons.

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NEW DIESEL-ELECTRIC DRIVE FOR EX-SAN FRANCISCO FERRIES

By CHARLES F. A. MANN

REPOSITORY of practically all the surviving bigtime Pacific Coast ferries and packet boats is Puget Sound Navigation Company of Seattle.

Prior to the war, the company, then frantically engaged in converting its once large fleet of steam packets formerly used in the north and southbound Puget Sound trade, to a fleet of cross-sound auto and passenger ferries—cast its eyes on the vast fleet of San Francisco Bay ferries about to be put out of business with the Golden Gate and Transbay bridges.

The result was that PSN acquired almost the entire fleet of usable ships, principally the finest of the big steel-hulled Bay boats as well as a neat fistfull of the huskiest and biggest wooden ships . . . all of which came up to Puget Sound to begin their second and perhaps most dramatic lifetime of useful service. At about 20 cents on the dollar of original cost, that is!

In acquiring and developing the 4800 hp. Diesel electric propulsion plant for the new Todd-built *Chinook*, discussed in our August issue, the company hit on the solution to repower the four big ex-Bay ferries still using their original Diesel-electric drives installed in 1927 when the ships were new.

Of all the San Francisco ferries, the best of the lot were the six Southern Pacific auto-passenger boats that performed a clockwork schedule between Oakland and the Ferry Building, practically 24 hours per day. These fine steel-hulled ships had 7 full lanes of auto capacity, the tall center lane being for high and wide truck loading, and had an average capacity of 85 cars and trucks and 600 foot passengers. Their Diesel-electric drive, modern for that day, comprised four 6 cylinder 4 cycle Nelseco Diesel generating sets, each driving a 250 volt generator and feeding current in a loop circuit to 1000 volt propulsion motors, one at each end of the ship, through a unique automatic control system to equalize the load on the pushing and pulling propellers, depending on which way the ship was being operated.

Twenty years have rolled by and these 6 ships play a very large part in transportation on Puget Sound. Their fine, heavy, well-maintained fireproof steel hulls and electric machinery is in as good condition in 1947 as it was in 1927, but the 20 year old Diesels have given their economic life to the job and are obsolete—yet still useful if economics were not pressing them toward the scrap pile. Each of the four Diesel generating sets weighed 90,000 lbs.—45 tons apiece.

Two of these ships became the *Willapa* and *Enetai*, with their original Nelseco machinery taken out to be used for spare parts for the four remaining ships, and were converted to single end drive with 2800 hp. Busch Sulzer Diesels, to increase speed and capacity for foot passengers.

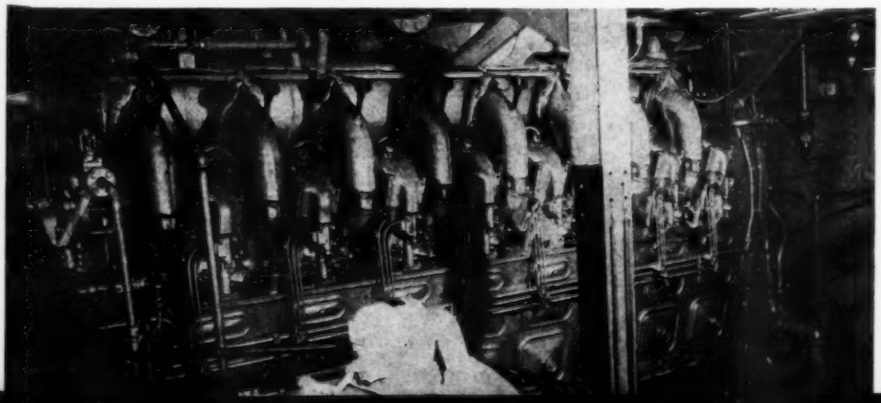
The remaining four of these ships, the *Nisqually*, Ex-Mendocino; *Quinault*, Ex-Redwood Empire; *Illahee*, Ex-Lake Tahoe and *Klickitat*, Ex-Stockton, operated in pairs, two of them on the fast, heavy Fauntleroy, (West Seattle)-Vashon Island-Kitsap County Mainland route, on 1½ hour round trip schedule. The other two operated on the Edmonds-Port Gamble (Olympic Peninsula) route on a 3 hour round trip schedule. The big converted *Willapa* and *Enetai*, finished just before the war, naturally have relatively new Diesels aboard. The war years wore out the other four hence today's quick conversion to the 1947 type of Diesel propulsion that not only enables 100% utilization of all the existing electric and auxiliary machinery, but speeds up the vessels by about 2½ knots, with no major changes in propellers or propulsion motors.

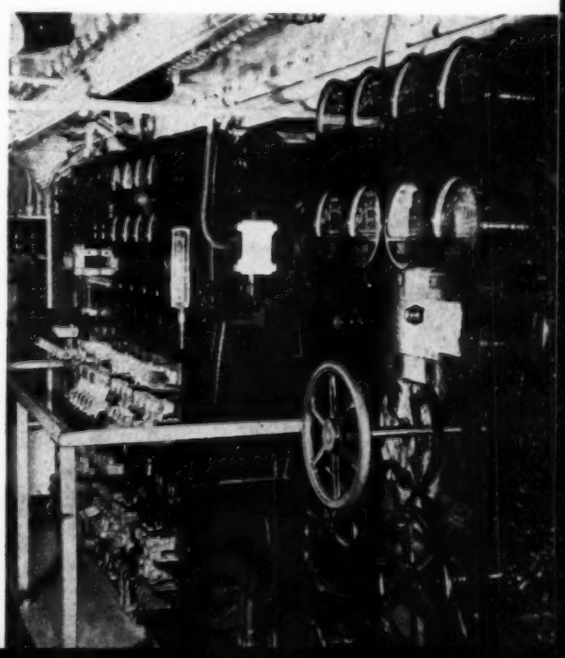
The four ships are approximately 251 x 46 ft. 3 in. at the waterline and 19 ft. 6 inches depth, and are rated at 1025 tons displacement. Each propeller is driven by a pair of d.c. propulsion motors, rated at 1250 hp. at 140 rpm. and current at 1080 amps. *Quinault* and *Illahee* have double Westinghouse motors and *Klikitat* and *Nisqually* General Electric motors. Elaborate control boards are fitted so that in operation, the pushing propeller motor and the bow propeller get equal current up to 50 rpm. turn of the wheels. Above this speed enough juice is fed the forward propeller to eliminate all drag and deliver a slight pulling effect at the same time. When the driving propeller reaches 140 rpm., the idling or forward propeller maintains a speed of from 95 to 100 rpm., the resistors automatically transferring the current from one pair of motors to the other.

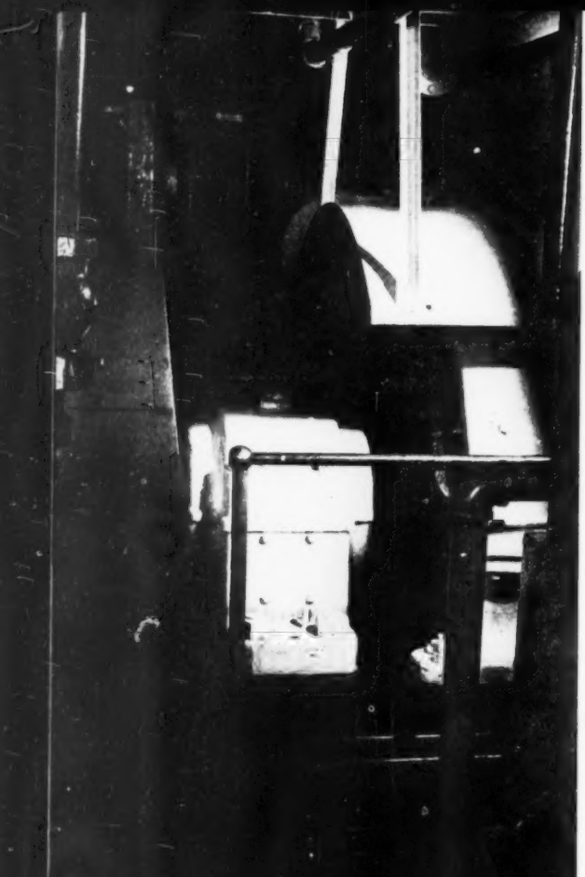
With their former small power plants, at no

(Right) Main Control Panel and Switch Board installation is identical on all four re-powered ferries.

One of two 1500 hp, 800 rpm. 16 cylinder General Motors Diesels installed aboard ferry. These two Diesels complete with Allis-Chalmers generators weigh under 50 tons compared with 90 ton weight of former installation.







Illustrations on this page show unique utilization of auxiliary generator-exciter sets of former installation. Picture above shows Morse silent chain drive connecting shafts of main engine and coupled auxiliary generators. Engine speed is maintained at 600 rpm to insure proper exciter voltage.

time did the propulsion motors ever reach their maximum capacity when under full load . . . a disadvantage on rush holidays where operating at 40 to 60% above rated capacity for short periods might effect improved schedules and add capacity to the day's run, with no damage to the underrated electric units in the drive.

The repowering job consisted of removing two of the 90,000 lb. old Diesel electric sets and replacing them with two 16 cylinder comparatively high speed, lightweight General Motors Diesels (Cleveland Diesel), each weighing but 49,000 lbs. including generator. Two of the old 90,000 lb. Nelseco heavy-duty sets were dismantled slightly, given several coats of white paint and kept inside the hull in their outboard (endwise) positions as ballast, of all things! The new General Motors units have 500 volt Allis-Chalmers generators delivering approximately 900 hp. at a reduced speed of 600 rpm. While these Diesels normally would deliver up to 1600 hp. at full speed, they are deliberately governed down to a fixed speed of from 600 to 620 rpm. for the primary purpose of turning the twin pairs of auxiliary generator exciter sets at constant speed, giving constant voltage and amperage to the ship's hotel and auxiliary power circuits and fixed excitation currents to the big propulsion motors and generators.

Neil McCullough, youngish Port Engineer of the Puget Sound Navigation Co. conceived the idea of salvaging the old auxiliary generators from the Nelseco sets and adapting them to the new layout. He took two of the 40 kw. 120 volt d.c. sets and mounted them rigidly to a single base, with sprocket fixed between the two generators, then hooked up an enclosed Morse silent chain drive from another sprocket on the main Diesel engine. Likewise a similar pair of 40 kw. exciter-auxiliary sets were coupled up with sprocket and chain drive to the other General Motors main Diesel.

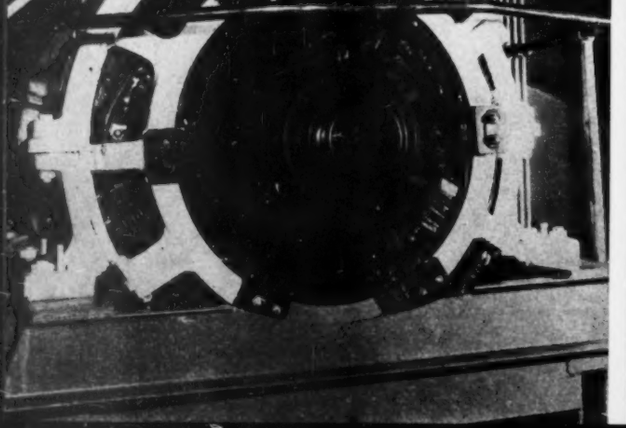
By fixing the governors on the main Diesels for constant speed operation, the injection arms being varied to the load only, the current of operating this almost completely electrified ship, is uniform and the lights don't blink. And the elaborate control circuits function perfectly. Mr. McCullough estimates he saved the company $30,000 by this ingenious hookup.

The 500 volt main generators feed the 1000 volt propulsion motors through a loop circuit. These big motors are cooled by free air circulation, while the Allis-Chalmers d.c. main generators are cooled by a Harrison cooler in a closed air circuit. The Diesels are all fresh water cooled in a closed circuit with Harrison heat exchangers and Sylphon valve controls on the hot water circuit. American Radiator heating boilers are fitted.

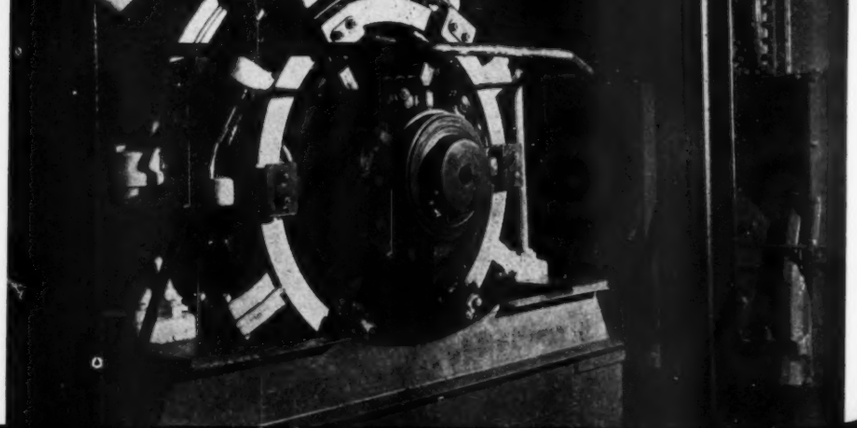
One of the 16 cylinder, under-rated General Motors Diesels will give up to 11½ knots speed and the two hooked together will give 14-15 knots, depending on whether or not they are slightly overloaded for short periods. With electric equipment geared for 100% overloads for periods as long as 1 hour, these vessels have no trouble in making 15 knots on short hops or in a traffic pinch.

Responsible for the conversion program on the 4 ships was Capt. Harry I. Anderson, the operating vice president of Puget Sound Navigation Co.; Neil J. McCullough, Port Engineer.

(Below) Two 40 kw. generator-exciters mounted on single base and coupled together driven by chain drive installation (right) through main engine. Duplicate arrangement set up for both main Diesels.



(Below) Another view of auxiliary drive arrangement looking forward. Use of former auxiliary equipment by means of chain drive saved company an estimated $30,000. With Diesels operating at constant speed no fluctuations of voltage interfere with ship's service power or main generator excitation current.



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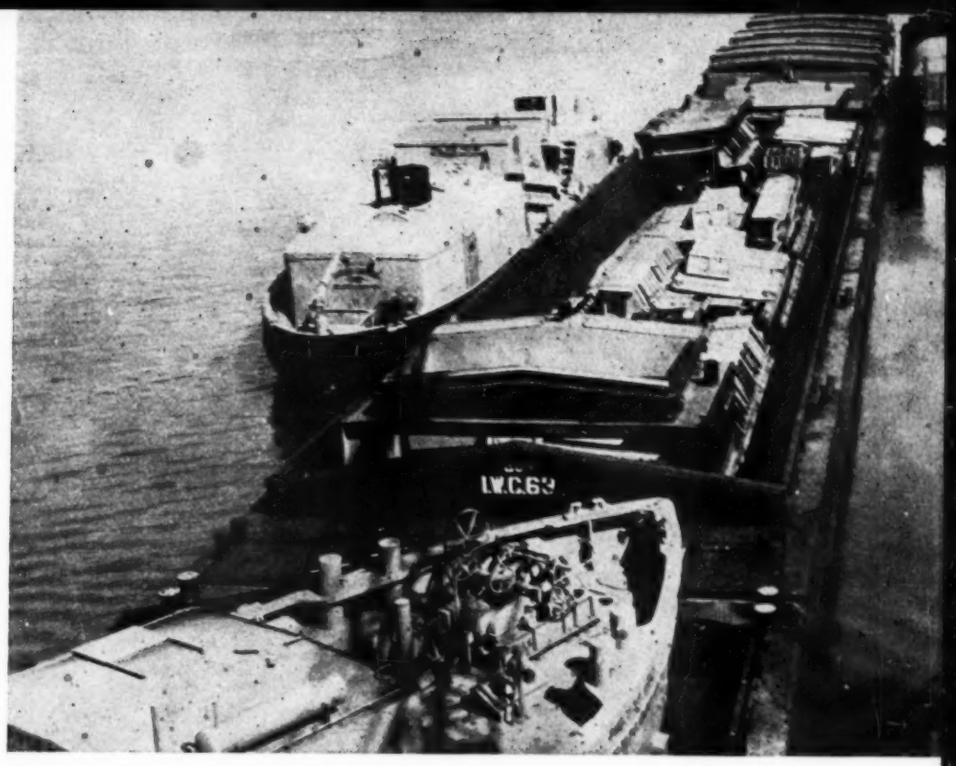


Knocked down Diesel engined barges shown loaded aboard lighters for voyage down Mississippi.

DIESEL-PROPELLED BARGES ON WAY TO FRANCE

THE first shipment of a fleet of 25 Diesel-propelled barges, built by The Ingalls Shipbuilding Corporation at Decatur, Ala., for the use of the French Supply Council on the Rhine River, was recently loaded on barges at Decatur, towed down to New Orleans and loaded on a freighter for Rotterdam, Netherlands, where they will be assembled. The first one, the Arbois, was completely assembled at the Ingalls yard at Decatur, tested on the Tennessee River, then dismantled for shipment.

Measuring 208 feet in overall length, the steel barges have a molded breadth of 23 feet and a depth, molded to main deck at side, of 9 feet. They are of all-welded construction.

The barges are powered by Enterprise Diesel engines, developing 480 hp. at 400 rpm. The power unit includes built-in lubricating oil pumps, fuel pumps, fresh and salt water circulating pumps, air compressor, turbo-supercharger and fuel and lubricating filters. Auxiliary power is derived from an auxiliary Diesel engine, arranged to drive a direct current generator of 10 kw. capacity, a bilge and ballast pump of approximately 150 gpm. capacity and a water-cooled air compressor. The engine is suitable for operating on a fuel oil having a gravity of 28° to 36°A.P.I., a viscosity of 35 to 50 S.S.U. at 100°F., and a flash point of 150°F. minimum. The fuel consumption at full load rated speed and power shall not exceed 0.47 lbs. per hour per shaft horsepower, based on fuel having a heating value of 19,000 Btu. per pound.

Seven bulkheads are fitted in the barges dividing the hull into eight compartments: fore peak containing chain locker, forward accommodations; three cargo holds, engine room, ballast tank and aft peak. The cargo hatch, about 18 feet wide, has a continuous side coaming about 2 feet, 6 inches high above the deck. The cargo space is divided into three cargo holds by two watertight steel bulkheads with a fixed athwartship steel tabernacle between coamings over each bulkhead. The cargo holds are divided by portable wood bulkheads with steel tabernacles over, varying in depth so that the bulkheads are of the same height and interchangeable. Each hatch section is fitted with three fore and aft portable steel strongbeams.

Galvanized steel covers formed and flanged in sections of about 22 inches width are carried in athwartship portable channels supported on the fore and aft strongbeams and on the coamings and starboard.

The boat's steering gear is of sufficient power to operate the rudder from hard over to hard over (120°) in 30 seconds when the barge is operated at full speed, and from hard over to hard over when going full speed astern at no specified time without in either case exceeding overload on motor in accordance with electrical specifications, and for the hydro-electric steerer without exceeding 1,000 lbs. per square inch oil pressure

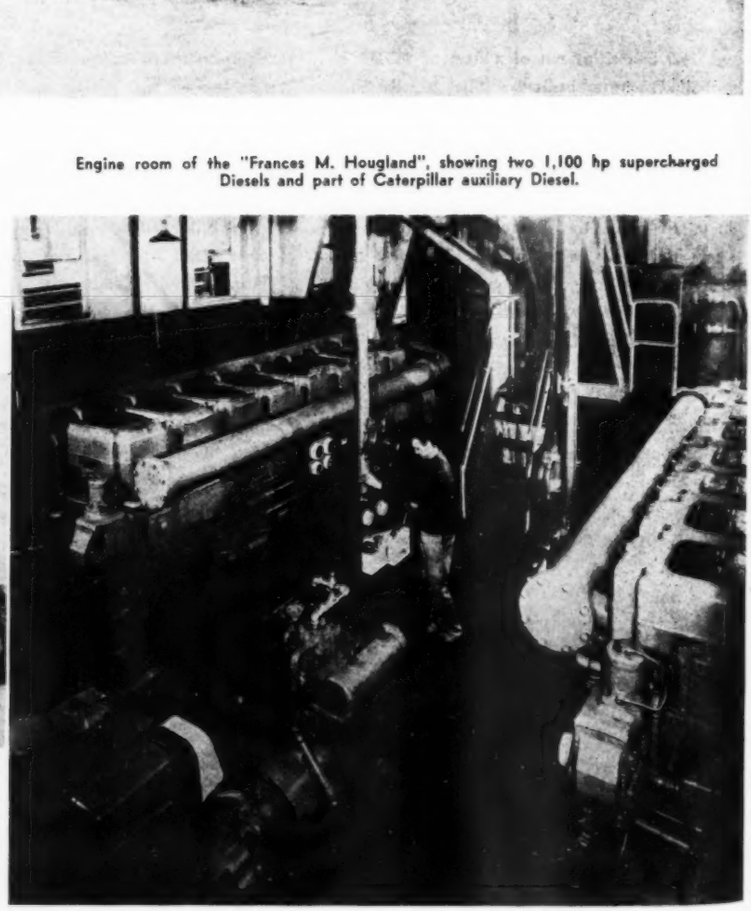
The barges are equipped with two hoisting winches: one hand and power, with drums, gypsies, latches, ratchets, flywheels and handles with safety attachments are located on the forward end and are used for hoisting the anchors and for warping. One hand winch, with drum, ratchet, flywheel and handle with safety device, is located aft for hoisting the anchor and for warping.

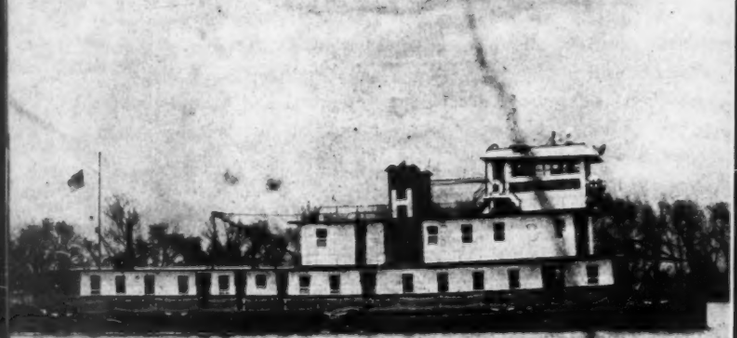
The living quarters aboard the barges are fitted out with closets, wash stands, drawers, shelves, and lockers for linen, dishes, cooking utensils and for dry stores.

Living quarters for six persons are located forward below deck, and for six persons on deck aft in a house of steel construction. Quarters aft and the engine room are fitted with radiators for heating with hot water supplied by heating boiler located in the engine room. All the stoves burn Diesel fuel oil.

Newest addition to the fleet of Walter G. Hougland, Inc. is the powerful and well equipped "Frances M. Hougland", 128½ feet long, 28 foot beam, powered by Cooper-Bessemer supercharged Diesels.

Engine room of the "Frances M. Hougland", showing two 1,100 hp supercharged Diesels and part of Caterpillar auxiliary Diesel.





Broadside view of the "Frances M. Hougland" taken during one of her trial runs near Paducah. Recently she handled a 60,000 barrel tow at 4½ miles per hour.

TOWARD MORE POWERFUL DIESEL TOWBOATS

THE *Frances M. Hougland,* newest addition to the fine inland waterways towboat fleet of Walter G. Hougland, Inc., of Paducah, has already tucked several new performance records into her relatively new log book—records that serve only to indicate that the newest trend in these powerful pushers points to bigger and better things along the banks of the Mississippi and its tributaries.

Launched during the early spring of this year at the ways of Nashville Bridge Company, this new and more powerful towboat has already been successful in pushing the largest tow ever to go up the Cumberland River, 78,000 barrels, from Paducah to Nashville in 57 hours.

On a trip from Port Arthur, Texas to Paducah, she pushed 44,000 barrels in 15 days, including 36 hours which were lost in loading at Port Arthur and eight hours lost while she was tied up in a fog.

Going from Helena to Paducah with 60,000 barrels of gasoline, she averaged 4½ miles per hour and required only eight days for the round trip.

Like several other members of the Hougland fleet, the *Frances M. Hougland* is Cooper-Bessemer powered. While not the largest on the inland waterways, she is one of the most powerful, being equipped with two Type JS-D.R. 8 cylinder turbo-supercharged Diesels rated at 1,110 horsepower each.

The hull of the *Frances M.* is almost an identical twin to the *Walter C. Hougland,* its predecessor in the fleet, being 128.5 x 28 x 8.5 feet. She is of twin-screw design but her appointments are more elaborate and she is much more powerful than the *Walter G.* because her engines are supercharged.

The boat is equipped with a Nashville-type tunnel stern which directs the water into two propellers and both steering and flanking rudders are provided.

Beautifully appointed passenger accommodations, including two guest bedrooms and a lounge, all panelled in walnut, with ceilings and bulkheads of soundproof material, are extra features. There is an inter-communications system aboard through which passengers may telephone to other parts of the boat. There are also adequate quarters for 16 crew members and officers, with plenty of shower and other facilities on all decks.

A well equipped galley and quarters for two cooks are located aft on the main deck.

A modern public address system, through which crew members can hear orders from the pilot house from all parts of the boat and a ship-to-shore radio, is also being carried.

The new boat is under command of Captain Lawrence Bachuss, who formerly served in a similar capacity on the *Walter G. Hougland.* The chief engineer is George Maynard and the mate is Leroy Harvey.

In addition to the two Cooper-Bessemer engines, the *Frances M. Hougland* is equipped with two D340 Caterpillar 15 kilowatt generating sets; one D 800 Caterpillar 30 kilowatt generator and 7 cubic feet air compressor; three Gardner-Denver air compressors; Century electric generators and motors; two Allis-Chalmers electric water circulating pumps; Square D switchboard and magnetic contactors; Tuthill transfer pumps, Fulton Sylphon valves, Briggs lube oil and fuel oil filters; Kirk Hobicht indicators; Carlisle Finch electric control headlights; a Crane heating plant; Fairbanks-Morse house water pumps; Kahlenberg three fluke steel wheels; Goodrich rubber strut bearings; Bowden hygiene water filter; Western Electric ship-to-shore radio-telephone system; Masco public address system; Carrier refrigerators; Elisha Webb oil range; Sunroc drinking fountains; Domestic self priming fire pumps and a Kahlenberg Commander air horn.

Close-up of the elevated screen and hoppers for loading sand and gravel into trucks. On this property are numerous holes where folks have dug for legendary treasure. The very real treasure here is the valuable gravel pumped up by the Buda Diesel.

Views of the Otis Bros. Sand & Gravel Company operation at Nicholson, Mississippi.

HIDDEN

IN the area around the channels of Pearl River, in the southwest corner of Mississippi, people are hidden-treasure minded.

The Pearl is quite a stream. Though not now cutting much of a figure for navigation purposes, this big river was formerly a trade artery, up which steamboats are said to have run beyond the city of Jackson. Other craft than steamboats have used the Pearl, especially the lower part. Down near the mouth, the river separates into the East and West Pearl Rivers, and the long island between these channels—Honey Island—has the kind of history you might expect. This jungle-like island has in times past been the headquarters of more gangs of pirates, horse-thieves, bootleggers and just plain outlaws than possibly any other spot of its area in the country.

Like most spots of ill-repute, its lore no doubt exceeds by far anything that ever really happened there; however, the tales still persist. Jean Lafitte was said to have been quite familiar with Honey Island and the rest of the lower Pearl River country, and whether this is true or not, people still are positive that there is something to these rumors, and every now and then you run into a few holes dug by the credulous in search of treasure buried by Lafitte or somebody else.

On one tract of land bordering on East Pearl River, near the town of Nicholson, Mississippi, treasure hunters have been successful; not referring to the numerous little holes dug here and there under the shadow of this or that oak or cypress and so many feet from some legendary marker, but to one big hole dug by a Buda Diesel under the auspices of the Otis Brothers Sand & Gravel Co., of Nicholson. While simple-minded money searchers have left their spade-marks on this same property, with no record of producing anything except the exercise involved, this firm of commercially-minded gravel diggers have found out that Nature is the one who really buried the most treasure, and that you can dig it up if you go about it correctly.

WEALTH UNCOVERED WITH DIESELS

By WILL H. FULLERTON

One good way, it seems, is with a Buda Diesel. This gravel pit is like most similar operations, consisting of a dredge pump, a line of pipe running to an elevated screen, complete with hoppers for loading trucks, except that the pumping offers more difficulty.

The pit itself is in the bottom of an old bed of East Pearl River, possibly twenty feet lower than the high land at its edge. The elevated screen is on this high ground, and appears to be all of fifty feet high itself. The dredge pump and machinery are on a float in the pit, and the mixture of gravel, sand and water is pumped from forty feet below water level. Altogether, this Buda-engined pump is lifting the aggregate well over a hundred feet, according to eye measurement, shoving the load through about 350 feet of 6-inch discharge pipe, and has been doing the job for nearly a year. So it's possible all right, though to look at that high screen, so far above the water level, nearly any layman and possibly a few experts would be willing to swear it couldn't be done.

The engine is a Buda, model 6-DC-844, industrial type, full Diesel, four cycle, six cylinder, able to run constantly at 1400 rpm. but operated constantly on this job at 1200. It is connected through a Twin-Disc power take-off to a Morris 6-inch heavy duty centrifugal pump, using a Gates V-belt drive from the take-off to the pump. A Jabsco pump, similar to the little pumps with rubber impellers which have proven so popular with Gulf fishing craft—is installed for priming the big pump. The Diesel also supplies power for the 2-drum Ideal hoists; one drum is reversible for swinging the boom, the other drum non-reversible for lifting the suction pipe. There is no cutter-head machinery, as no clay is mixed with the sand-gravel deposit and straight suction does the trick: no cutting is needed.

The Diesel is electric starting, using Delco-Remy starter and generator. Lube oil filter is the DeLuxe, cartridge type; Purolators filter the fuel oil. Fuel injection is American-Bosch. For cooling the Diesel, an immersion coil sunken in the flotation water is used, giving the same effect as a keel cooler on a boat.

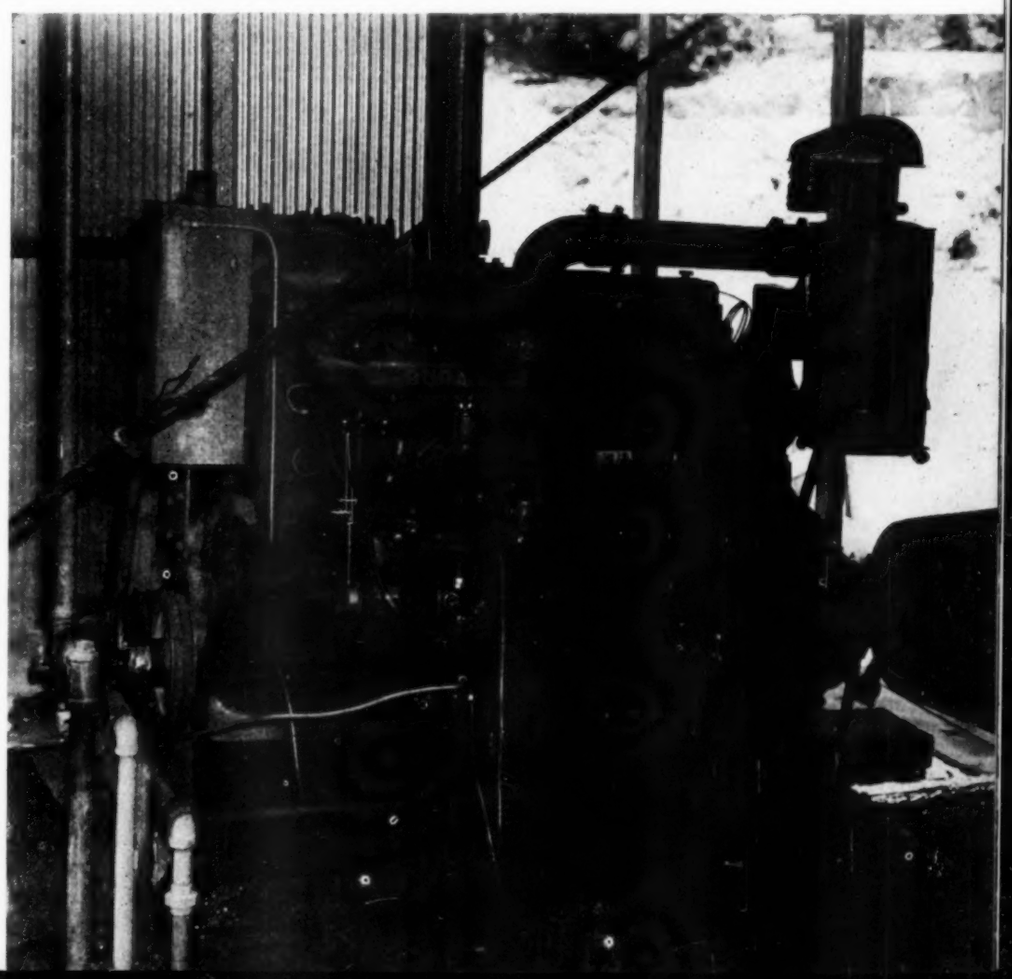
The dredge capacity is around twenty yards of large gravel, plus incidental pea gravel and sand, per hour, going to Mississippi and Louisiana for road building, construction work and similar needs. The pea gravel is exceptionally uniform in size, the big gravel just as useful and the sand is unusually "sharp," making it good for concrete or plastering work. This sub-surface sand differs greatly from the sand on the banks of the river itself; it's an old adage among plasterers that Pearl River sand is not sharp enough for gypsum plaster, but this remark simply does not apply to the sand from this Nicholson gravel pit.

This sand is so sharp, in fact, that it has caused the only trouble on this operation. Every now and then the impeller on the dredge pump has to have attention; this sand wears it down rapidly. The whole pump housing had to be replaced once for the same reason.

But that's the only trouble. As mentioned before, the Diesel has been running this dredge for nearly a year, with no complaints as to its economy or efficiency, no breakdowns and no repairs. In fact, according to the operators, it is "the best-working 6-inch dredge in the country" and that's that!

Sale and installation was made by the Gulf Engine & Equipment Company, New Orleans, distributors for Buda Diesels. "They told us," say the dredging crew, "that they would always be ready with parts and service. Well, that's nice, but we never seem to need parts and service on this Buda!"

The Buda Diesel, 6-DC-844, and the Gates V-belt drive turning the 6" Morris pump.



D.E.M.A.–SPONSORED EDUCATIONAL PROGRAM AND MARINE CONFERENCE

MAKERS of Diesel engine parts and accessories formally joined forces September 12 with the makers of Diesel engines themselves, in a five-year educational program designed to help colleges and universities turn out a better type of engineer. It was a move without precedent in any industry and the chairman of the organization meeting, E. J. Schwanhausser, aptly summed up the proceedings by a simple but graphic comment, "Something new is being created here today."

Actually, the formal action of parts and engine builders at the Copley Plaza Hotel in Boston was the culmination of a plan that the Diesel Engine Manufacturers Association had conceived months ago, and to which it had obtained pledges of cooperation, one by one, of the engine parts builders.

The plan is an outgrowth of three years of educational work which up to now has been shouldered by the association itself, it was explained by Mr. Schwanhausser, who heads the association and is vice president of Worthington Pump & Machinery Corp. Methodically since 1944 the association has visited the accredited mechanical engineering schools of the country, checking their needs and finding them, in many instances, to be acute. Laboratory equipment in particular was inadequate.

Diesel Engine Manufacturers Association has been able to improve the situation insofar as the needs directly related to Diesel engines themselves were concerned. It has become increasingly apparent, however, that educational problems are inseparably tied up with such factors as governors, fuel injection systems, lubricators, pistons, piston rings, fuels, lubricants, filters, silencers, crankshafts, camshafts, instruments, bearings, superchargers and radiators. There could be but one conclusion: the parts makers' cooperation is needed to help the schools graduate a better type of engineer.

"And the better the engineer who produces and services Diesel engines," Mr. Schwanhausser commented, "the better performance these engines will give; and that, gentlemen, in the long run, is going to benefit all of us."

Gordon Lefebvre, president of Cooper-Bessemer Corp. and chairman of DEMA's educational committee, expanded on the help the association has given the schools. Diesel Engine Manufacturers the country over have been "hosts for the day" to visiting college instructors who in some instances have travelled hundreds of miles, and at their own expense, to tour the factories and see first-hand the latest manufacturing processes and research projects, so that they might return to their classrooms better equipped to teach their students. Manufacturers have taken the opportunity also to show their guests the educational aids that they, the manufacturers, had to offer them, such as working models, cutaway sections, films, slides and literature.

The intensive two-week "refresher course" held in 1946 at Pennsylvania State College with that school's cooperation, and the one-week session held this year at Chicago, when two schools and three factories were visited, also were described.

"As a result of our efforts," Mr. Lefebvre said, "the laboratory equipment of the schools is twice as good as it was two years ago. The caliber of the instructors also is better. But text material is inadequate and calls for serious improvement.

"There is a real need for the cooperation that you parts and accessory makers can give us."

A preview of some of the activities this cooperation will include, was disclosed by Harvey T. Hill, executive director of Diesel Engine Manufacturers Association. He asserted that George H. Amberg, recently added to DEMA's staff to devote his full time to educational work, will visit all schools "to get first-hand the complete picture of their laboratory equipment, text material, and outline of their courses. His advice and counsel will improve many situations.

"As a result of his efforts and our overall program," Mr. Hill continued, "I am sure you will find that a year from now the schools will have better equipped laboratories, better text material and, in many cases, better courses, with thesis work being done in practical fields, in a practical manner."

He then threw open the meeting for comments and suggestions from the 27 representatives of parts manufacturers who were present.

Net result was the unanimous carrying of a motion that DEMA's board of directors appoint a committee to head up and carry through a cooperative educational program to be set up

Partial view of the speakers' table at recent D.E.M.A. Conference. Left to right are G. F. Twist, executive vice president, Atlas Imperial Diesel Engine Co.; Milton Friedberg, president, Wolverine Motor Works Inc.; Robert H. Morse Jr., vice president and general sales manager, Fairbanks, Morse & Co.; Gordon Lefebvre, president, Cooper-Bessemer Corp.; J. L. Alphen, president, General Seafoods Corp.; Thomas Rice, executive secretary, Federated Fishing Boats of New England and New York; Frederick B. Craven, vice president, Boston Towboat Co.; E. J. Schwanhausser, vice president, Worthington Pump and Machinery Corp.; Wm. S. Newell, president, Bath Iron Works; George W. Codrington, vice president, General Motors Corp.; and Vice Admiral E. L. Cochrane, head of naval architects school, Massachusetts Institute of Technology

by the makers of Diesel engine parts and accessories, and makers of Diesel engines.

Companies which had formally pledged their participation at the time of the meeting are:
Air-Maze Corporation
American Air Filter Company, Inc.
American Bearing Corporation
American Bosch Corporation
Bacharach Industrial Instrument Co.
Burgess-Manning Company
Commercial Filters Corp.
De Luxe Products Corporation
Diesel Engineering & Manufacturing Corp.
"DIESEL PROGRESS"
Elliott Company
Erie Forge Company
Illinois Testing Laboratories, Inc.
William W. Nugent & Co., Inc.
Ross Heater & Manufacturing Company, Inc.
Woodward Governor Company
Young Radiator Company

Firms which had not as yet joined in the program, but had signified their interest by having representatives present, were:
Double Seal Piston Co.
Farrel-Birmingham Co.
Fram Corp.
Manzel Bros.
Purolator Products, Inc.
Sun Oil Co.

Following the above meeting the group joined the Maritime personnel of New England who pulled off their coats and held a "shirt sleeve" session with Diesel engine manufacturers from the east, the central west, and from as far away as California. It was the third and final of three major regional conferences the Diesel Engine Manufacturers Association has held at key Marine Centers of the United States.

Consensus of those present who were at San Francisco last fall and at New Orleans last spring, was that this session at Boston's Copley Plaza topped the other two. A new element had been added—it was the Diesel engine parts and accessory makers who remained over from a morning meeting in which they pledged their support to DEMA's educational efforts. The speaking program was excellent—fast-moving, pungent, colorful, packed with meaty topics.

Then, too, it was a shirt sleeve session in both a literal and a figurative sense. The high thermometer impelled every man jack of the 154 present to peel his coat—Navy Admirals not excepted—which not only accentuated the informal tone of the get-together, but doubtless peppered up the exchange of questions and answers between floor and rostrum.

The frankness that characterized the Boston meeting and its predecessors has been one of the chief reasons they have been worth while. Engine builders haven't gone to the meetings to hear their products praised. Nor have their customers praised them—unless they saw fit to do so. No one on either side of the fence has pulled punches.

(Top right) E. J. Schwanhausser, president of DEMA and vice president of Worthington Pump and Machinery Corporation addresses banquet audience. To his left are F. B. Craven and Thomas Rice.

J. L. Alphen, president of General Seafoods Corporation discusses the increasing application of Diesel to the fishing industry.

William S. Newell, president of the Bath Iron Works, Bath, Me. tells his audience of the "good old days" of the Diesel engine as he experienced them.

Starboard side view of the speakers table—left to right are William E. Corrigan, vice president, American Locomotive Company; Rear-Admiral John J. Brown Jr., commander U.S. Naval Base, Portsmouth, N.H., Dwight Simpson, naval architect, John G. Alden Co., and Harvey T. Hill, executive secretary, Diesel Engine Manufacturers Association.

Vice Admiral E. L. Cochrane, head of naval architects school at Massachusetts Institute of Technology delivered a ringing tribute to the Diesel's performances in wartime.

GIANT LOGGING TRUCKS HAUL 250 TONS

By W. J. GRANBERG

ON the world's largest logging venture, in the Skagit Basin area in the northern part of the State of Washington, Diesels were called upon to aid in the gigantic task of hauling the logs out of the woods where an estimated one billion board feet of timber is being felled. Obviously, heavy and sturdy equipment was needed for the job which involved even the construction of 50 miles of road between the timber stand and the Canadian river down which the logs are floated to tidewater.

The new and mammoth Kenworth Model 588 truck with a Pointer-Willamette Company trailer were detailed for the hauling task, and ten of them are powered with Cummins Diesel engines. These four-cycle, six-cylinder supercharged engines develop 275 horsepower at 2100 rpm. Its weight, with standard equipment, is 2850 pounds. The peak torque developed in highway use by this model Cummins is 620 lbs.

The hauling chore performed by this engine is over 22 miles of good graveled road with adverse grade ranging from five to seven per cent. The loads themselves are what make news, for each truck hauls up to 50,000 board feet, or 250 tons. And the logs range as long as 80 feet. All of which means that not only the logging project itself, but the hauling job of the trucks is going down in the Paul Bunyan history of the Pacific Northwest as being unexcelled.

The Cummins engine used on this project is giving about four miles to the gallon of fuel, although fuel consumption depends upon the variations in load. Ordinarily, highway usage with the Diesel should yield up to five and one-quarter per gallon, but the Skagit Basin hauling chore could hardly be termed "ordinary" usage. This water-cooled engine, with five and one-eighth inch bore and six-inch stroke has a piston displacement of 743 cubic inches.

An unusual feature of the Kenworth trucks is its Knuckey-Brumbaugh dual chain drive bogey. This is an adaptation of the M-26 tank retriever chain drive which proved so effective during the war. The logging operators say there is no chain breakage, but little sprocket wear, and virtually no repairs with this new-type chain drive.

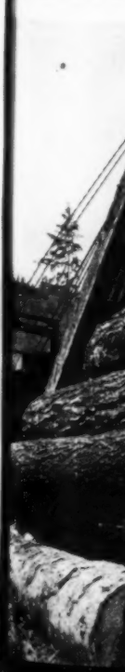
The logging project which called up such heavy equipment for service in the north woods is an international joint venture of Morrison-Knudsen Co., Inc., DeLong Engineering & Costruction Co., J. A. McEachern Co., Inc., and the Silver-Skagit Logging Co., Ltd. The latter company, a Canadian firm, is managing the operations and doing all the log hauling. The enterprise originated with clearing of a forested site for the reservoir which will be formed by Ross Dam on the Skagit River in northern Washington. The reservoir, 33 miles long, will extend eight miles into Canada. The only access to the timber was from the Canadian side of the border and Canadian interests were drawn into the logging to make possible cutting of timber from the American side, a project which would have been too costly alone, considering the road construction, long haul, and booming and towing of the logs on tidewater.

The DeLong Company designed the trailers which were built by Pointer-Willamette, and also supplied Kenworth with the truck rear ends, transmissions, auxiliary transmissions, and the Cummins engines. The component parts for the truck rear ends, developed for this particular hauling job, were purchased and the finished job patented by Sound Equipment Co. The truck assembly job, including construction of the cab, installation of wiring, controls, and front end, was done by Kenworth. Thus was the end product, a truck built and powered for a heavy hauling job, the result of the work of many minds, along with innovations and adaptations of equipment, in producing a completed trucking unit fitted for the work.

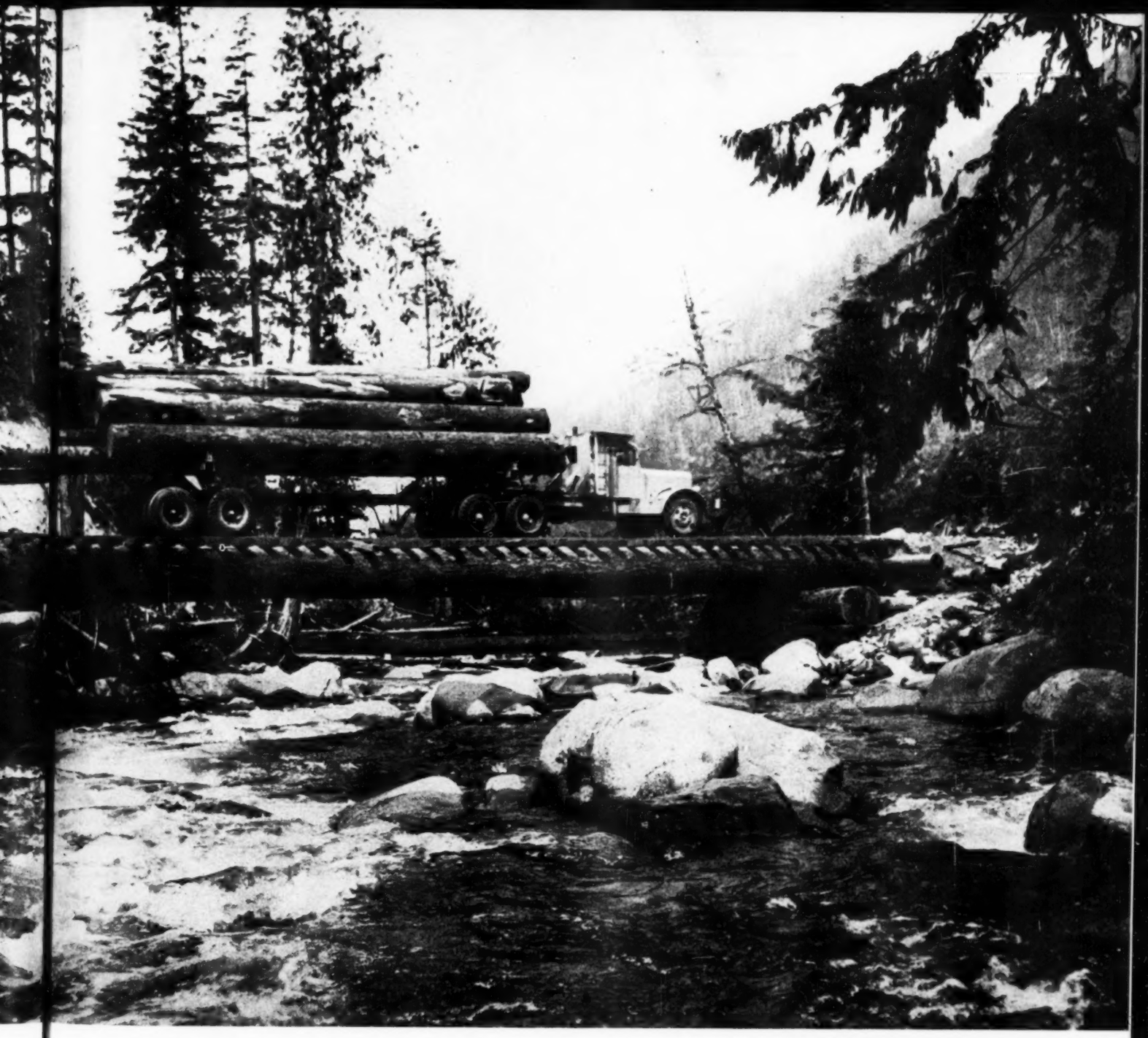
Although the road haul from woods to river is the hardest, it is not the longest. The logs are made up into booms at the main booming grounds on the Fraser River, near Hope, B. C. From there the logs destined for the United States are towed 81 miles downstream to the mouth of the Pitt River where heavier tugs pick them up for towing to the mouth of the Fraser. Ocean-going tugs finish the trip to mills at Everett and Anacortes, Washington.

(Above) Cummins-engined Kenworth truck with 16,000 board feet of timber crosses homemade bridge on Vancouver Island.

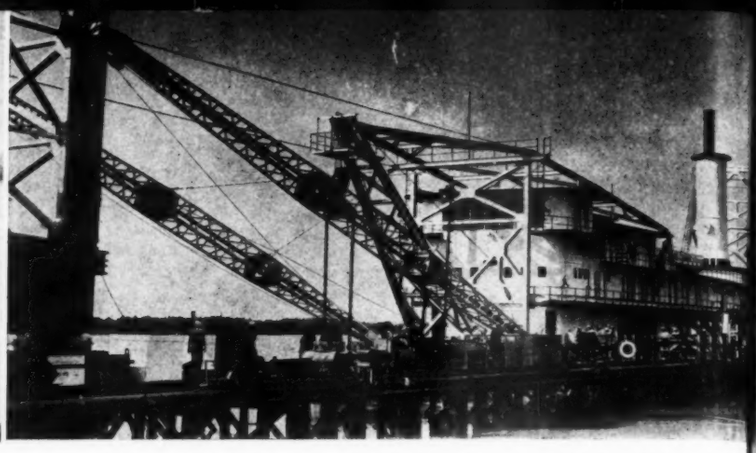
(Far right) 275 hp Cummins Diesel under hood of this Kenworth truck enables 22-mile hauls and 50,000 board foot loads over gravel roads.



(Right) In northern Washington state, world's largest logging operation is underway. Here another Kenworth truck loads up.



Steel dredge "Shirley #1" recently repowered with a 700 hp Enterprise Diesel.



195-foot dredge "Caribbean" equipped with auxiliary Diesels Buda and Waukesha.

DIESEL DREDGES ON THE MISSISSIPPI

*By WILL H. FULLERTON

ALONG in 1940 they built the all-steel dredge *Shirley #1* for the Port Arthur Dredging Company, of Port Arthur, Texas. She is a sizeable outfit, measuring 96 ft. 6 in. overall length, with a beam of 26 ft. and 5 ft. molded depth, with an average working draft of 4 ft.

She was planned not for off-shore work, but to operate in harbors, rivers and canals near to electric power lines. Her main dredge pump was a 16 in. American Manganese Steel Co. product, driven by a 600 hp. electric motor, and when the juice was available, the *Shirley #1* could dig up many a yard of creek bottom in the course of a day. However, regardless of the performance under good conditions—meaning when electricity was handy—the fact that the dredge had to depend on this type of power was a decided handicap. The field was too limited; there were too many good jobs possible where a power transmission line was too inconvenient and too expensive to reach, and the owners looked for a power plant which would need less special attention. A tankful of oil seemed to be more practical fuel supply than a line of cable which had to be moved every time the dredge was moved, so the electric motor was removed and a Diesel engine took its place.

The new power plant was a Enterprise Diesel, turning out 700 hp. at 550 rpm. The Diesel drives an American Manganese centrifugal pump with 20 in. suction and 16 in. discharge; the discharge head is varied by changing the engine speeds between 510 and 550 rpm., using two sizes of pump impellers, one being 38 in. diameter and the other 42 in. Besides going Diesel for the main dredge pump, auxiliary Diesels were also installed. One is a 180 hp. Buda, driving a Westinghouse generator, and the other a 220 hp. Waukesha, also driving an AC generator. These two generators provided plenty of current for powering all the electrically-driven apparatus aboard, including the 50 hp. motor on the Mundy hoist, and the 120 hp. motor driving the cutter of basket type, 5-blade cast steel, turning 18 rpm.

Now the dredge could go anywhere, regardless of power lines; it could operate successfully in twelve inches of water and with a minimum width of 80 ft. The dredge was in due course of time sold to the McWilliams Dredging Co., of national reputation, with offices in Chicago and New Orleans, and presumably continued to deliver satisfaction. A report on the dredge in 1946 stated, "This dredge was last docked in 1945 and is in excellent operating condition. It has just completed a 50,000 yard job on the Wolf River (Mississippi), where its output averaged approximately 350 yards per hour."

In "excellent operating condition" after several years of gruelling work. If there is any steadier, rougher work demanded of a Diesel than powering a big dredge pump, we don't know just what that could be. This Enterprise, it seems, had done everything that was asked of it and retained its full mechanical health in the process. There was little special equipment: the cooling system is closed, operated by the fresh and salt water pumps on the engine 250 lbs. of starting air is carried in a 32 in diameter tank 8 ft. in length. The Diesel and pump assembly are mounted on a steel foundation, of heavy construction, the engine and pump being direct connected using a Thoma flexible coupling. Operation frequently was on a 24-hour basis, using a normal crew of 16 men. This consistent performance of the Enterprise Diesel did not go unnoticed, apparently; concerns of the caliber of the McWilliams Dredging Co. have a habit of keeping pretty accurate cost sheets and are usually guided accordingly.

So when the firm planned the construction of a couple of the largest dredges in the country, Enterprise came along too. The new McWilliams dredges are the *Caribbean* and *Chicago*. The latter will not be completed, probably until November, 1947, but the *Caribbean* was turned over to the dredging company, complete and ready to go, on June 30. Avondale Marine Ways of New Orleans was the builder, and is also constructing the *Chicago*. These dredges really are large. Length is 195 ft.; beam 48 ft 6 in.; molded depth, 15 ft. Bottom and side plating is heavy, ½ in. and 9/16 in. There are a pair of longitudinal bulkheads and four transverse ones. A 36 in. deep double bottom between the longitudinal bulkheads handles the water ballast and boiler feed water; wing tanks provide space for fuel oil. Diesel fuel and filtered water.

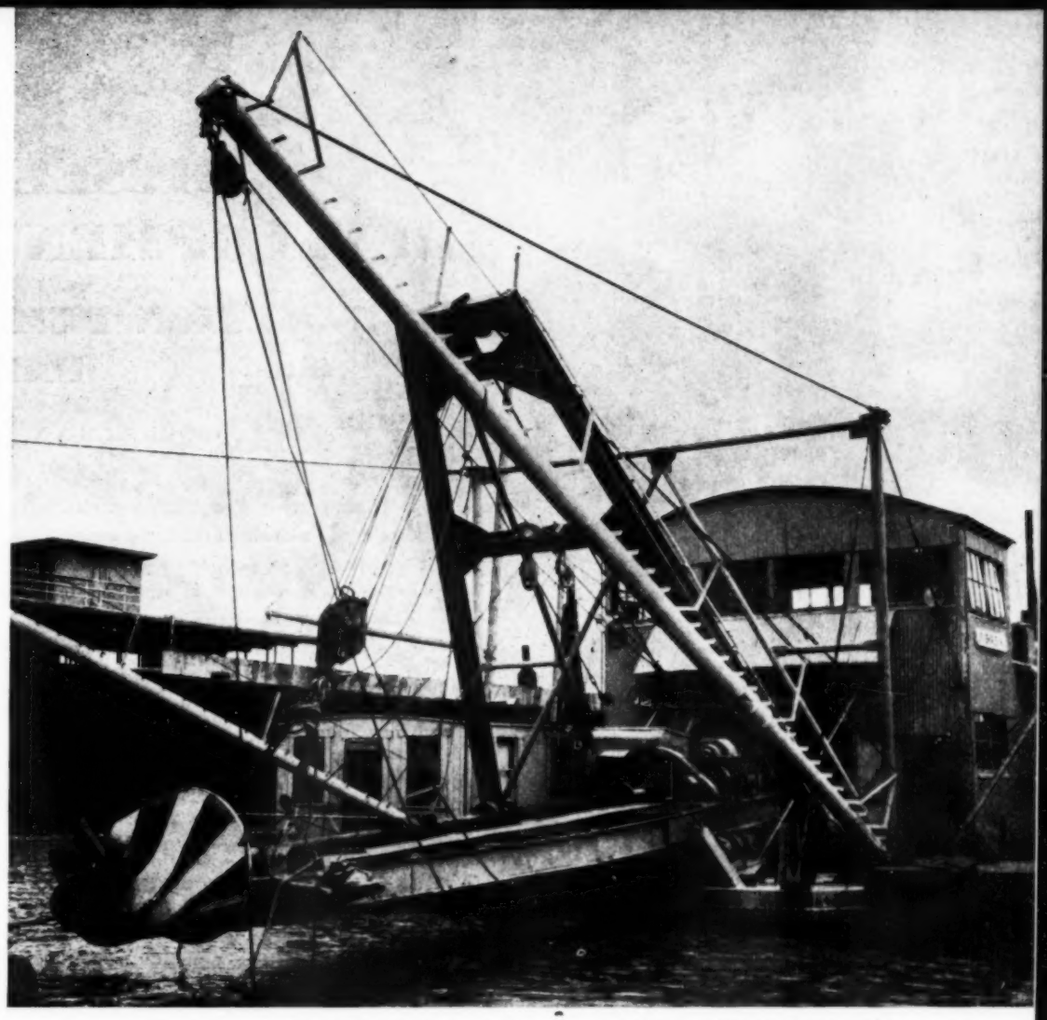
The main dredge pump is 28 in. diameter discharge, 24 in. intake, designed by McWil-

liams, driven by a DeLaval geared turbine; the pump can absorb 6500 bhp. Turbine-driven generators supply power for all auxiliary pumps and compressors. However, as there are certain periods when the boiler and turbines are not in operation, a dependable auxiliary is needed and that explains the Enterprise aboard, introduced no doubt by the record of the *Shirley #1*. The Enterprise Diesels on the *Caribbean* and the *Chicago* are identical. Both are the model DSG-18, four cycle, eight cylinders, 12 in. by 15 in., developing 650 hp. at 500 rpm. They are stationary rather than marine engines; there is no reverse mechanism. Being specifically designed for dredge operation, however, these Diesels have certain marine features, such as the two lube oil suctions in the crankcase. One of these is forward, one aft. As a dredge, no matter how large, is still a floating object, it follows that the decks or floors will not always be level; so the two suctions are built-in to assure a dry sump at all times.

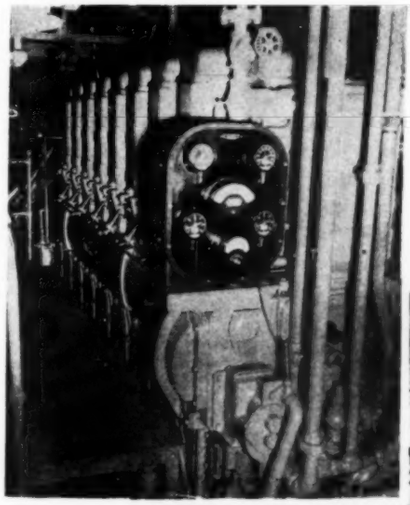
Woodward hydraulic governors, maintaining constant speeds regardless of load, are part of each engine's equipment. Fuel is cleaned by Winslow fuel filters; Honan-Crane clarifiers protect the lube oil. Alnor pyrometers, as always on Enterprise Diesels, are installed with thermocouples for each cylinder. Starting is by air. The dredge has a 250 lb. compressed air system and air is used for many other purposes aboard besides engine starting. Actually, the Enterprise Diesels require only 100 lbs. of air for starting; they kick over easily.

The Diesels are direct connected to Crocker-Wheeler generators, in tandem, the first of 300 kw., the second 150 kw. The engines were furnished by Enterprise Engine Co., Inc., of New Orleans, a subsidiary of the Enterprise Engine & Foundry Co., of San Francisco. This New Orleans branch is under the management of Paul Wabnig and serves the whole Gulf area. Yes, these new McWilliams dredges are big fellows. Their crew's quarters are roomy, furnished and arranged with more than average comfort. Air-cooling is by ducts installed throughout, with an eye to possible air-conditioning later on. The galley is equipped with deep-freeze, and there is also a cold storage room. The dredge also has ice-making equipment aboard. And all these modern improvements will demand a dependable electrical supply.

Those aboard, however, will not worry overmuch about any failure of electricity. For when the turbines are silent, there's always the Enterprise to depend upon.

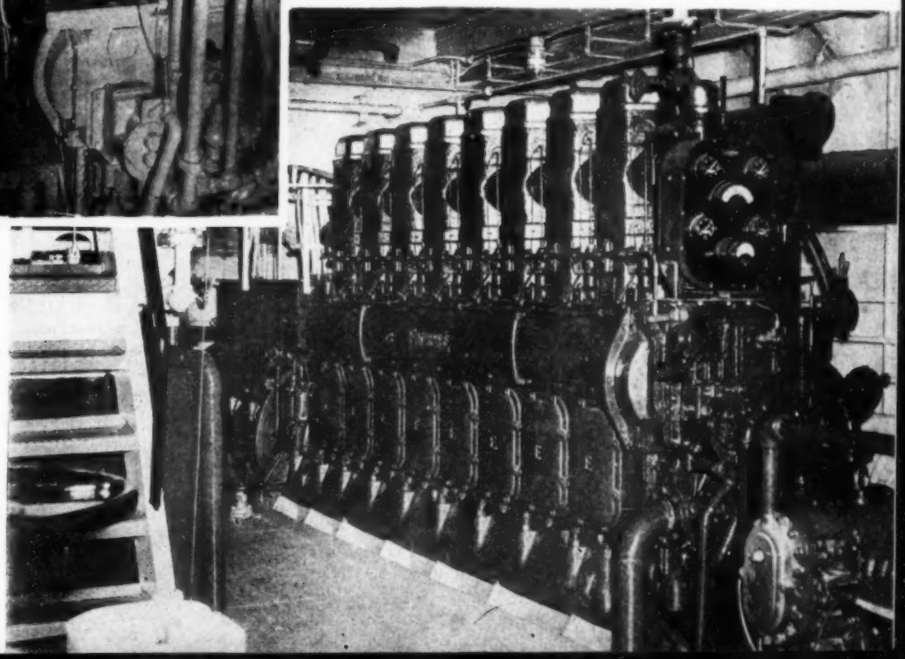


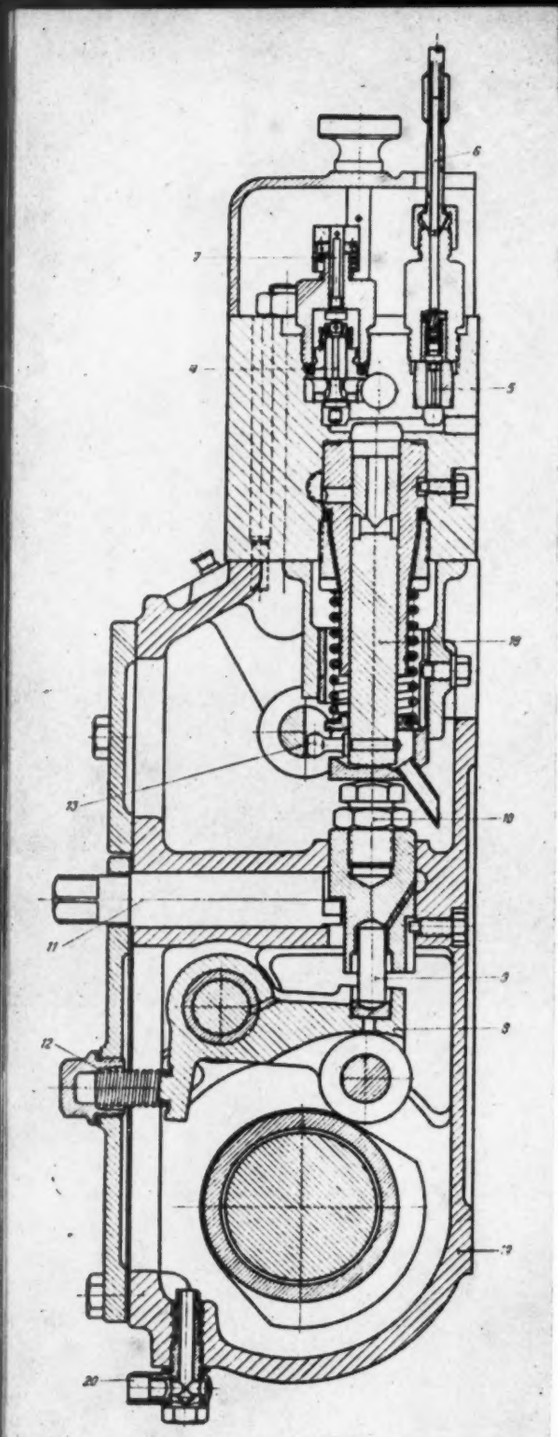
Close up of "Shirley #1" showing dredging gear. Waukesha and Buda Diesels supply auxiliary power for hoist and dredging cutter.

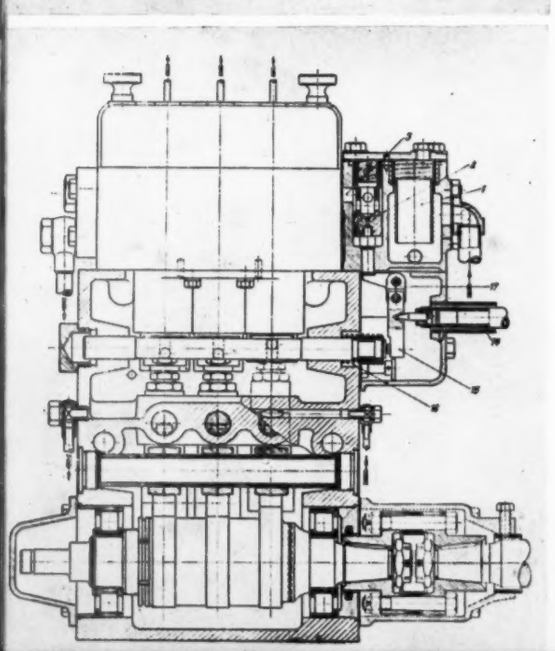


700 hp Enterprise Diesel drives main dredge pump aboard "Shirley #1."

Enterprise Diesel installed aboard Caribbean for auxiliary power.







DIESEL ENGINE DEVELOPMENT IN GERMANY

INJECTION PUMPS AND NOZZLES PART II

By KALMAN J. DE JUHASZ*

THE Injection Pump of Motorenfabrik Deutz, Fig. 9, is characterized by the intake valve (4), delivery valve (5), and by port controlled spill. The construction is explained in the caption. Some noteworthy features: The deaerating valve (7) is operated by hand; when it is pressed down it opens also the intake valve (4). With the eccentric shaft (11) the plunger can be operated manually (for deaerating and filling the fuel pipes after long disuse), or be held permanently in its upper position in order to render the particular unit inoperative. In this latter case the roller arm (8) is lifted by the spring (12), to keep the roller out of engagement with the cam. The amount of delivery can be varied by rotating the plunger about its axis by means of moving horizontally the governor bar, notches in which engage with the spherical arms (13) fitted in the plungers. The governor bar itself is urged into its maximum delivery position by the spring (16), and is actuated by the governor rod (14) through the lever (15). Should any plunger, or the governor bar seize, then the governor rod (14) will lift the intake shut-off valve (2), which cuts off the fuel supply and stops the engine.

The Injection Pump of Friedrick Deckel A.G.-Muenchen (Figs. 10, 10a, 10b, 10c) was developed during the war, or shortly before it. It is characterized by a helix controlled spill port, and by intake and delivery valves stacked one above the other as shown in Fig. 10 and 10a. The reasons for the use of intake valve instead of the usual intake port controlled by the upper edge of the plunger are:

a. Upper edge of plunger is liable to be eroded by the high velocity spilled fuel, whereby the beginning of injection is altered and made uncertain.

b. Fuel delivery starts immediately on the return stroke of piston, hence the volumetric efficiency of the pump is higher, i.e., for a given delivery the pump can be built with a stroke shorter than a pump having a port-controlled intake. On the other hand, this construction involves an unsymmetrical, rapid rise cam, instead of the tangential cam used in port-control intake pumps. Fig. 10 shows a concave cam which is more difficult to produce and occasions higher accelerations and stresses than a straight sided or convex sided cam.

c. Fuel delivery quantity is practically constant with varying camshaft speed. (With port-controlled inlet the delivery quantity increases with increasing camshaft speed.)

Some other features of interest are:

d. Each pump barrel can be removed separately without disturbing the other barrels.

e. The pump barrels together with the suction valve assembly and the delivery valve are mounted in one block, which in turn is fastened to the camcase by means of studs. The entire block is easily removable from the camcase and thereby the tappets are rendered accessible and removable. The intake manifold in this block is separated from the spill manifold, with only a narrow passage connecting the two, whereby the surge effects caused by the high pressure spill fuel are damped out.

f. The injection quantity is regulated in the usual manner by rotating the plunger. This is accomplished by a geared sleeve arranged

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* *Professor of Engineering Research, The Pennsylvania State College (Scientific Consultant, Technical Industrial Intelligence Division, Department of Commerce).*

Fig. 9. Injection Pump of Motorenfabrik Deutz: 1—Filter. 2—Quick Stop Valve. 3—Passageway. 4—Intake Valve. 5—Delivery Valve. 6—Delivery Pipe. 7—Deaerating Valve. 8—Roller Arm. 9—Connecting Rod. 10—Adjustment Screw. 11—Eccentric Shaft for Lifting the Pump Plunger Manually. 12—Spring for Lifting Roller Arm. 13 — Ball-end Arm for Rotating the Plunger. 14—Governor Rod. 15—Governor Lever. 16—Spring for Governor Bar. 17—Bell Crank Lever. 18—Plunger. 19—Housing. 20—Discharge Pipe Connection for Leakage Oil.

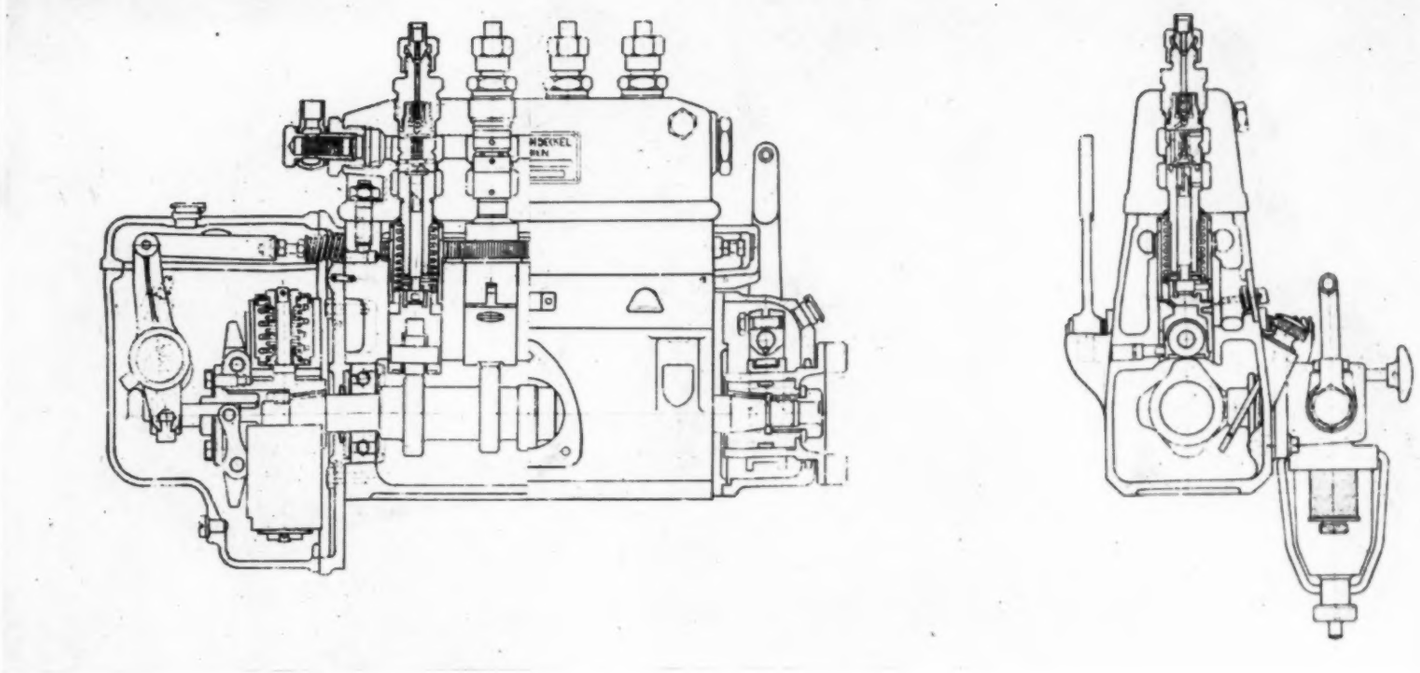

Fig. 10. Injection Pump of Friedrich Deckel A.G.—Muenchen.

coaxially with the plunger and having in it a slot engaging with a radial arm formed on the lower end of the plunger. A control rack operated by the governor engages with these geared sleeves.

This pump has been built with plunger diameters of 6 to 10 mm, for a maximum delivery of 150 mm^3, and is usable up to 2200-2400 rpm. camshaft speed. It is fitted with supply pump, with a direct coupled (i.e., not geared) fly weight governor, and with a phase shifter coupling for advancing and retarding the phase of injection.

The Deckel pump is built also in the type shown in Fig. 10a, without camshaft and camcase, these latter elements being incorporated in the engine itself. The arrangement of intake and exhaust valves is shown clearly in this figure.

Fig. 10b illustrates the operation of the pump in its various phases of plunger travel and rack setting.

Fig. 10c shows the transfer pump for the Fr. Deckel injection pump.

The Archaoulloff Injection Pump of the Krupp-Germania Werft (Fig. 11) is operated not by a camshaft, but by a piston acted upon by the compression pressure of the engine. Thus it requires no mechanical drive and thereby simplifies the construction of the engine. Its original purpose, at the time of its first introduction in 1918, was to facilitate the conversion of air injection Diesels to direct injection. The Krupp-Germaniawerft, A. G., Kiel, has done considerable development work on this type of pump and brought it to a high state of perfection. A recent design is shown in Fig. 11.

The compression pressure from the engine passes to the device through pipe connection (A), and acts upon piston (D). Gas tightness is attained with the aid of piston ring (E) and packing rings (F). The latter are made of three segments which are pressed against the piston by a spring ring. The piston is moved upwards by the springs (J). It is to be noted that two springs (J) are provided, acting in series, but separated by a sliding collar arranged on the outside of barrel (H); this construction reduces the tendency to spring surge. The piston is lubricated by means of the lubricating oil connection (I). The piston force is transmitted to the pump plunger (G), and when it exceeds the force of spring (J), the plunger is pressed downwards, effecting the injection. The fuel is introduced into the pump chamber through the spring loaded intake valve (M), and it is passed to the injection nozzle through the opening (K). Regulation of fuel quantity is accomplished by means of cam (R) which forms part of a lever oscillating on the fulcrum (N), and actuated by the gas piston (D) by means of the joint pin (S). The action of the cam (R) is transmitted to the intake valve (M) by means of a spring steel blade (P); the latter serves to eliminate side thrust on the intake valve stem. When, on the downstroke of piston (D), the cam (R) opens the intake valve (M), the injection ends. The fulcrum (N) is an eccentric, the position of which is adjustable manually or by governor. Depending on the position of (N), the opening of intake valve (M) takes place earlier or later during the downstroke of piston (D), and thus the injected fuel quantity can be altered. The beginning of injection can be altered within limits by means of the throttling pin (B), regulating the rate at which the pressure gases can enter into the space above the piston (D). During the scavenging period, the pressure in this space is released into the engine cylinder through ball-valve (C).

A characteristic of the Archaouloff pump is that, with decreasing compression pressure, the beginning of injection is retarded. This occurs in ship engines when the engine load (and

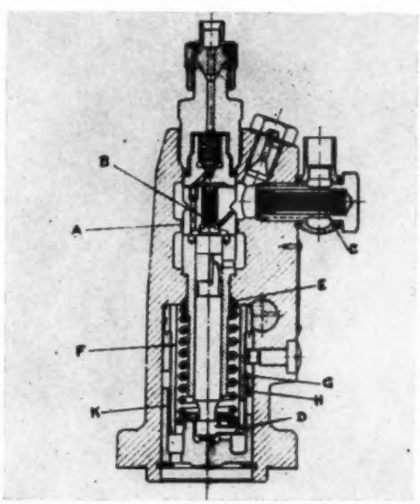

Fig. 10a. Deckel Injection pump: A—Passage between intake and spill space. B—Intake valve. C—Intake filter. D—Plunger rotating arm. E—Upper spring plate ring. F—Plunger rotating sleeve. G—Sleeve holder. K—Tappet.

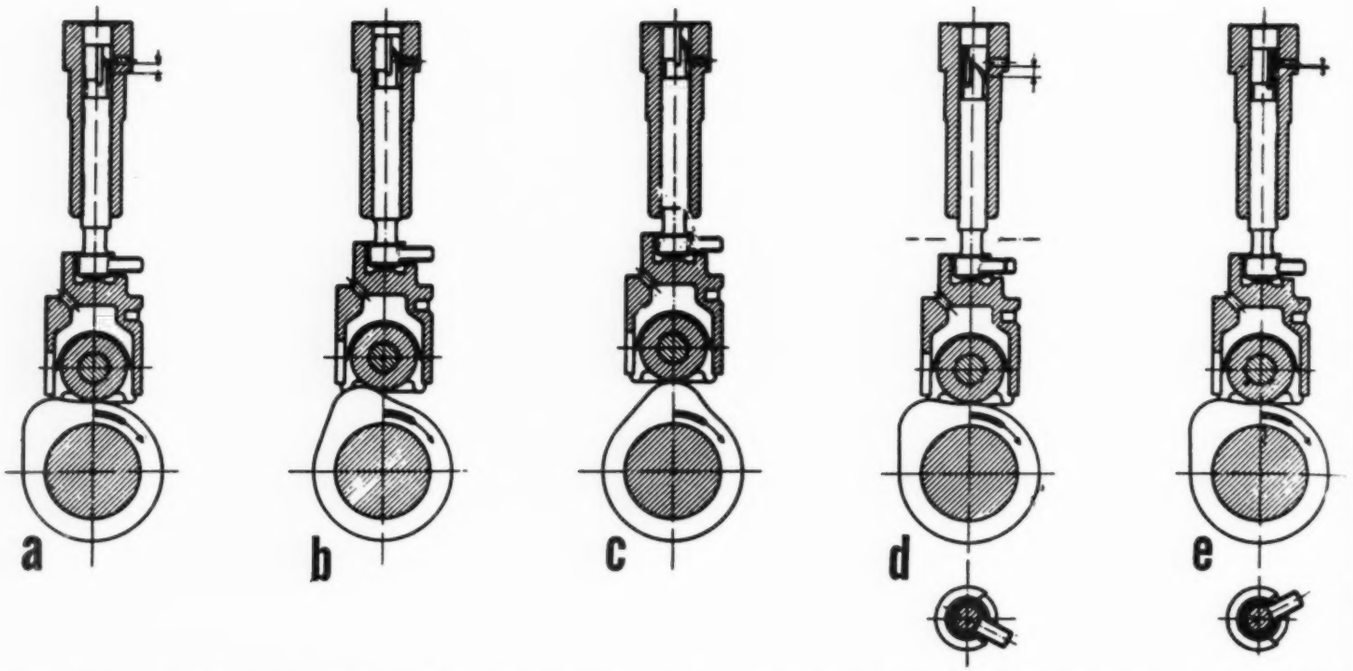

Fig. 10b. Operation of the Deckel-pump: (a) Start of plunger travel (lowest plunger position); the spill port is covered by the plunger by an amount equal to the useful lift. (b) End of effective stroke; the helix angle begins to uncover the spill port. (c) End of lift (uppermost plunger position); spill port open. (d) Full load position (at lowest plunger position the spill port is covered by the amount of the useful full load lift). (e) Stop-position (the spill port is uncovered by the lowermost plunger position.)

speed) decreases. Some retardation of injection with decreasing speed is desirable. But at very low engine speeds such as at starting, this retardation is excessive, and has to be compensated for by reducing (manually) the spring loading of the injection nozzle.

On account of its comparatively large moving masses, this pump in its present form is adapted chiefly for low speed engines; the highest speed used by Krupp Germaniawerft is about 250 rpm. Nevertheless, it appears possible to design this system with smaller moving masses (possibly using diaghragm instead of the piston) and thereby adapt it for high speeds, and possibly reduce its cost.

The reduction of the spring load of the nozzle can be accomplished also pneumatically, by compressed air, as will be described later (Fig. 16). It appears to be an obvious advantage to incorporate the nozzle with this pump and locate the unit directly in the cylinder head. For large engines such modification was deliberately avoided, in order to keep the unit a separate constructional subassembly, and preserve its accessibility and the interchangeability of parts. For small, high speed engines, however, such a modification appears to have considerable merit, and some efforts have been made for its utilization in France. (See J. E. Tuscher: Publications Scientifiques et Techniques der Ministere de l'Air. No. 89. 1939. Published also as N.A.C.A. T.M. No. 993. Direct Injection in Internal Combustion Engines. 1941.)

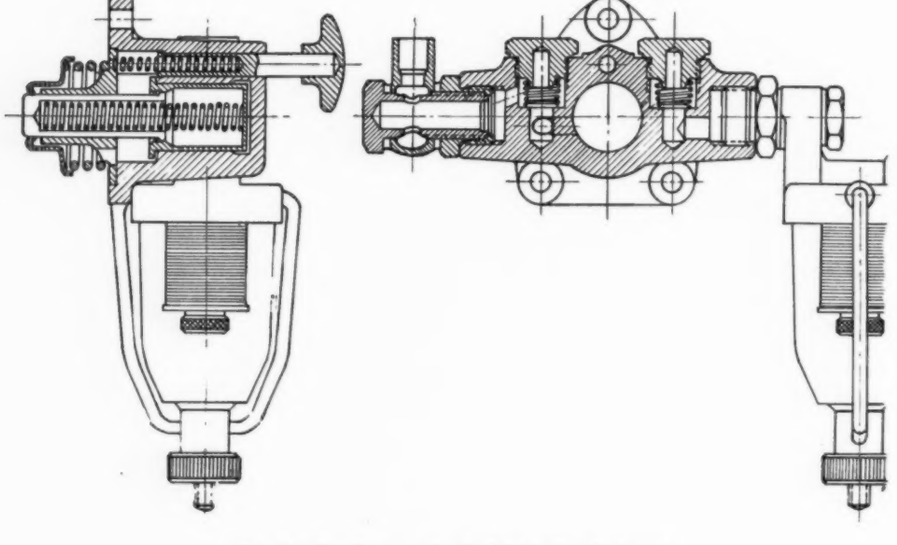

Fig. 10c. Transfer pump for Deckel Injection Equipment.

The design of nozzles follows the well known and tried out spring loaded needle construction. Some trend toward flat seated needle valve used in conjunction with an interchangeable orifice plate was noticeable (in preference to the conical needle tip and integral nozzle) as shown in Fig. 12. Burmeister and Wain A.S. and Fr. Deckel A.G. favored flat seat construction and were emphatic about its superiority over the conical seat type. Some representative nozzles will be described.

1. The Water Cooled Nozzle for large M.A.N. Engine. (Fig. 13) is intended for a direct injection Diesel engine of large size. The annular

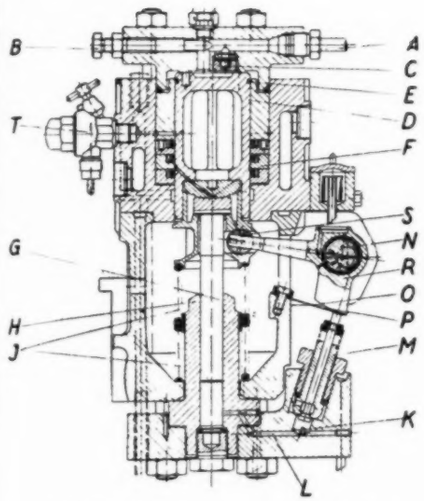

Fig. 11. Archaouloff Injection Pump of the Krupp-Germaniawerft. A—Pipe Connection to Engine Combustion Space. B—Throttling Pin. C—Gas Exhaust Valve. D—Gas Piston. E—Piston Ring. F—Packing Rings. G—Plunger. H—Bushing. J—Plunger Return Spring. K and L—Passage to Nozzle. M—Intake Valve. N—Fulcrum for Cam Lever. R—O—Cam. P—Spring Blade. S—Joint Pin for Cam Lever R. T—Lubricating Oil Connection.

space between the orifice plate and needle valve seat is cooled with oil, or preferably with fresh water. The details of the design are clearly shown in the illustration.

2. The Uncooled Nozzle for Deutz A.G. engine (Fig. 14) has a flat valve seat, and a separate orifice plate are used. The valve spring acts directly on the needle valve, without the interposition of a rod (as in Fig. 8). This construction reduces the inertia of the moving part, but it locates the spring in a zone of higher temperature which is not particularly desirable.

3. The Water-Cooled Nozzle for large F.I.A.T. Two-Cycle Engine (Fig. 15) is not of German but of Italian manufacture but it is included here because it is a good representative of nozzles for large cylinders. The small annular water space around the orifice plate (2) insures an intensive circulation of cooling water and hence high rate of heat transmission.

4. The Nozzle for Archaouloff-Injection Pump (Fig. 16) deserves special consideration.

As stated in the description of the Archaouloff pump, it is necessary to reduce the needle valve spring load at starting and at low speeds because under such conditions the compression pressure is not sufficient to deliver the fuel against the normal injection valve opening pressure. Therefore a pneumatic cylinder is mounted above the needle valve for reducing the needle valve spring load. At starting, compressed air is admitted automatically under the piston (G), whereby this is moved upwards by about $\frac{1}{8}$ in. and thereby reduces the compression of the needle valve spring by that amount. The amount of expansion of the spring can be finely adjusted by the stop limit screw (K). It is, of course, possible to make use of this arrangement not only at starting, but also to leave it operative at all speeds and loads, e.g., in the case of a low grade fuel. The arrangement of the water jacket is noteworthy. The outer sleeve (1) is made of two parts and it is welded together with the nozzle body. The tube (2) is slipped over the nozzle and it is secured against axial displacement by the clip-ring (3). Rubber rings (4) at the top and bottom ends serve to prevent leakage of cooling water.

5. Nozzle of Saurer A.G. (Fig. 13a) is noteworthy on account of its compact construction.

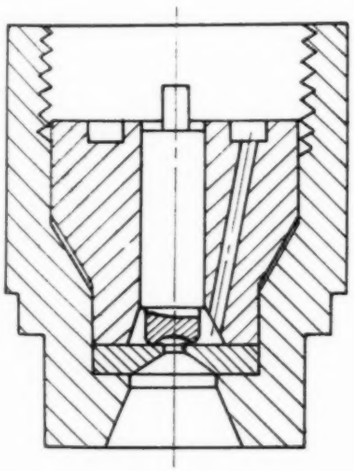

Fig. 12. Flat seated needle valve, with interchangeable orifice plate, of Fr. Deckel A.G.—Muenchen.

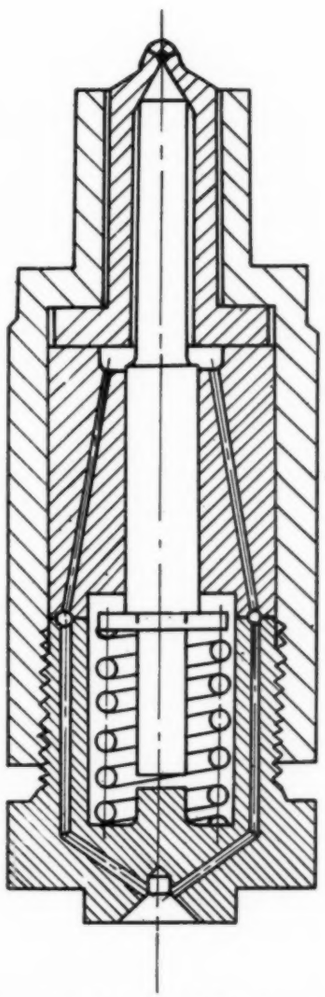

Fig. 13A. Nozzle of Saurer A.G. Note compact construction.

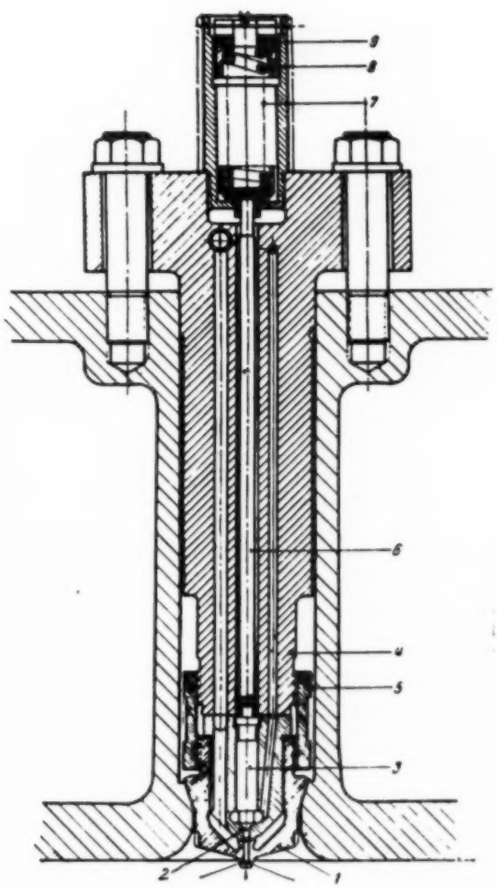

Fig. 13. Water Cooled Nozzle for a M.A.N. Engine with 11.2" dia. x 16.5" stroke (285 mm x 420 mm) x 400 r.p.m. 1—Orifice plate with 8 orifices of 0.25 mm dia. 2—Valve seat. 3—Needle Valve. 4—Nozzle Body. 5—Retaining Nut. 6—Pressure Rod. 7—Spring. 8—Spring Housing. 9—Upper Spring Support. Screw for Adjusting Spring Force.

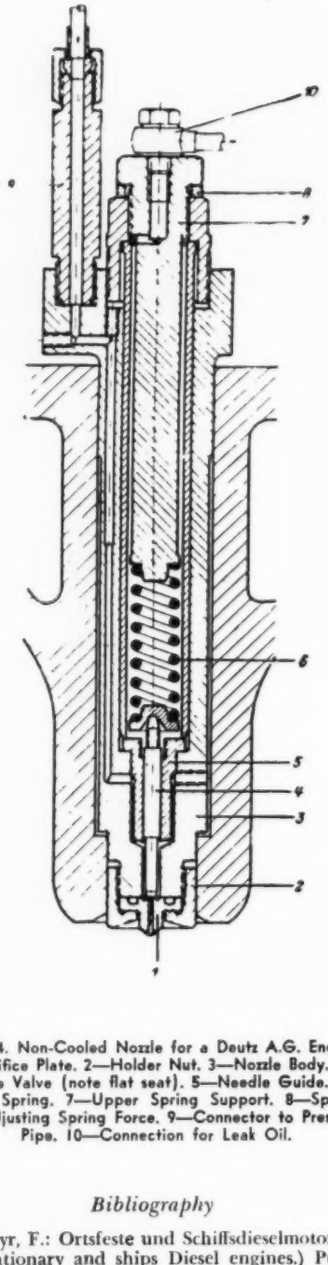

Fig. 14. Non-Cooled Nozzle for a Deutz A.G. Engine. 1—Orifice Plate. 2—Holder Nut. 3—Nozzle Body. 4—Needle Valve (note flat seat). 5—Needle Guide. 6—Valve Spring. 7—Upper Spring Support. 8—Spacer for Adjusting Spring Force. 9—Connector to Pressure Pipe. 10—Connection for Leak Oil.

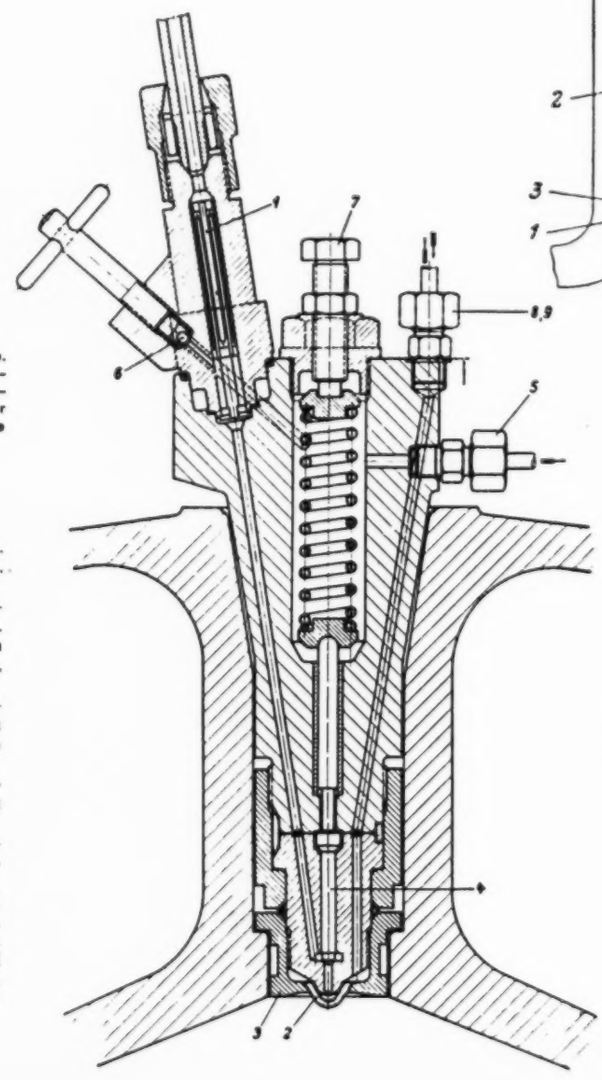

Fig. 15. Water Cooled Injection Nozzle for large Fiat engine. 1—Filter. 2—Orifice Plate. 3—Orifice Nut. 4—Needle Valve. 5—Connection for Leak Fuel. 6—Air Release Valve. 7—Spring Compression Screw. 8-9—Connection for Cooling Water.

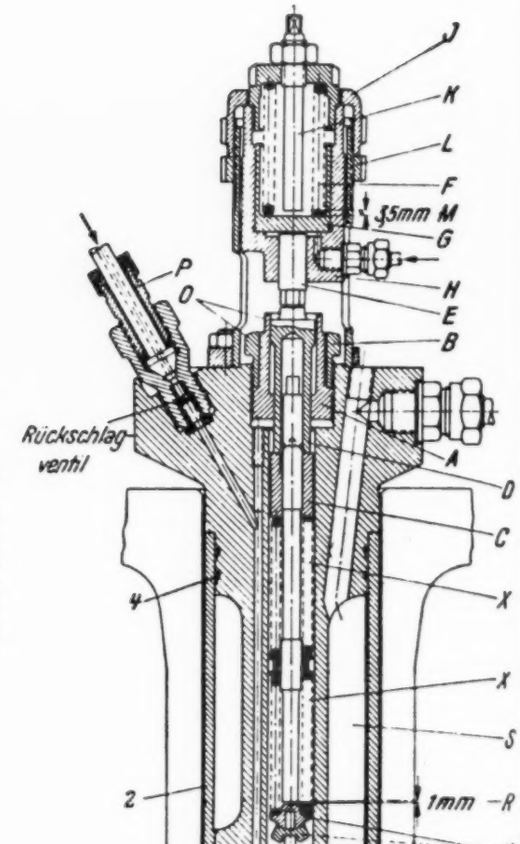

Fig. 16. (Right) Injection Nozzle for Archaouloff-Pump. A—Nut for Adjusting the Needle Lift. B—Counter Nut for A. C—Pressure Transmitter in Valve. D—Forked Piece. E—Connecting Bar to Pressure Release Cylinder. F—Spring and G piston in H Pressure Reduction Cylinder. J—Nut for Adjusting Valve Spring Force. K—Stop limit screw. L—Lock nut for J. M—Travel of Pressure Release Piston. O—Setting of Needle Lift. P—Connection to Pressure Pipe. R—Needle Lift. T—Nozzle Nut. U—Nozzle. W—Needle Bushing. X—Needle Valve Spring. Y—Spherical Pillow Blocks.

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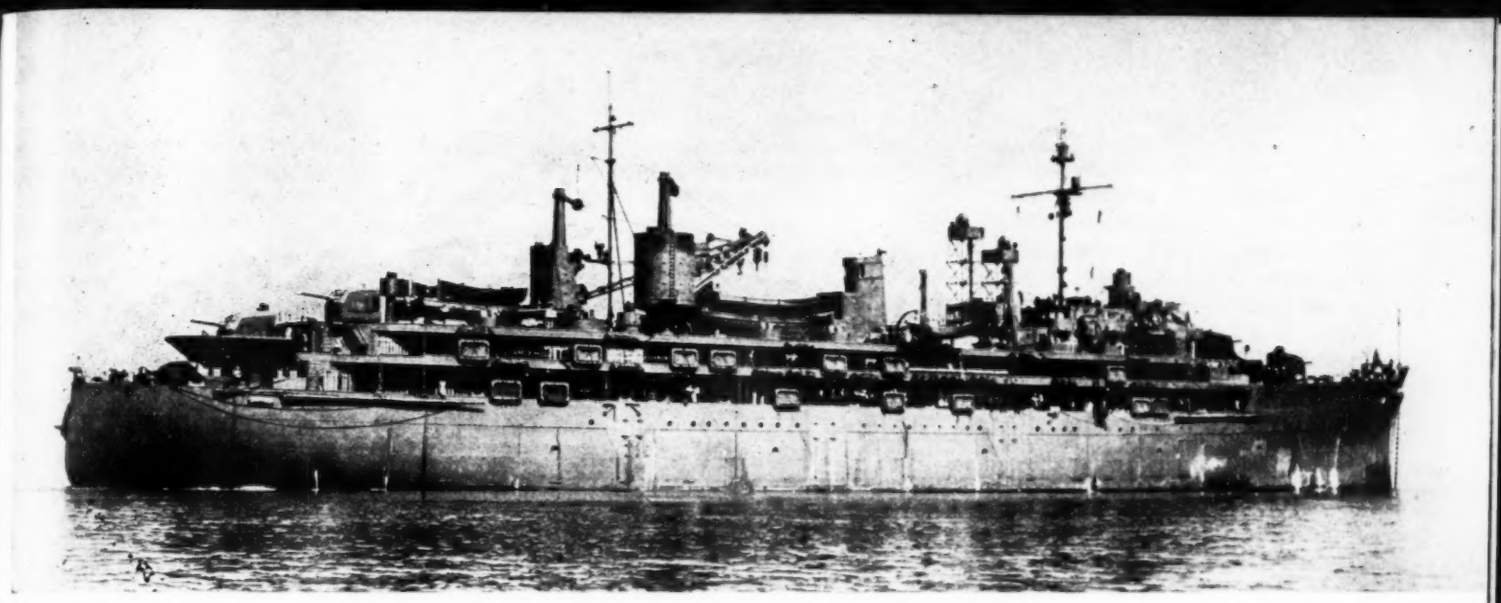


U.S.S. "Proteus"—18,800-ton submarine tender—one of seven Diesel engined tenders built during war.

NAVY SUB TENDERS

Point Way to Dieselized Merchant Marine

FOREWORD

By C. A. LOCKWOOD

Vice Admiral, U. S. Navy

The "Proteus" was one of a group of very excellently designed submarine tenders whose equipment was so completely adequate that, with two of these vessels, plus a 2500-ton floating dry dock, we were able to establish immediately in capture enemy Islands, submarine bases which otherwise would have taken many months to build.

With the aid of such advanced bases, we were able continually to cut down the distance between our submarine refitting activities and Japanese ports and shipping lanes. Thus we were able constantly to tighten the noose with which Japan and her stolen territories were being economically strangled.

We of the Submarine Forces give full credit not only to the men who designed and built these splendid ships, but also to the Navy personnel who manned them and who so ably serviced our fighting submarines.

WARTIME construction of marine Diesel-electric propulsion machinery for the U. S. Navy, Coast Guard and Army exceeded the aggregate horsepower of motorships built for the Maritime Commission. Their operation under extreme conditions proved their ability to stand the gaff of gruelling service under the care of rapidly trained operators, and confirmed the sound engineering judgment of the Bureau of Ships, Navy Department. Over 100 vessels, including submarines, exceeded 5,000 bhp. per installation, and fifteen ships exceeded 10,000 bhp. Yet, despite their remarkable economy and reliability, no contemplated program of the Maritime Commission, or construction plans of American private shipowners, included Diesel-electric motorships of power approaching that of the submarine tenders discussed in this article. This position offers food for profound thought, because foreign shipyards are full of large Diesel-driven motorships under construction, which will form tomorrow's competitors of the U. S. Merchant Marine.

Seven 18,800-ton motorships were completed for service as submarine mother ships and placed in service by the U. S. Navy before the termination of World War II. The high-powered machinery of these vessels formed an important departure from the engineering practices common with the propulsion of large American merchant ships. Similar hulls and engines would make very desirable and economical passenger-cargo liners or fast freighters. Therefore, shipowners should closely study these naval auxiliary craft and carefully compare them with turbine-driven commercial vessels of their size and power, insofar as the machinery installations are concerned. The Cleveland Diesel Engine Division of the General Motors Corporation was selected to equip these seven noteworthy motorships with a total of well over 100,000 hp. in main and auxiliary engines. Some of them now have had six years' service, so have been well tested.

Each ship has a top loaded displacement of nearly 19,000 tons, and a full war strength of about 1,100 officers and men, as well as accommodations for about 500 men from submarines when their crews need relaxation and rest. At the present time, the ships are operating with crews of peacetime strength.

An outstanding feature is that, although each vessel has about 15,800 bhp. in Diesel engines for her combined main and auxiliary power, and is capable of a speed of 17 knots, the two main Diesel-electric engine rooms occupy a joint length of only 66 feet by the width of the hull. There also is a heating-boiler and evaporator room between the two 33-foot machinery compartments, which a fast cargo liner probably would not need, as arrangements possibly could be made to utilize the waste exhaust gases at sea, and carry the same to a boiler mounted on a flat over the engines. In the case of Navy ships, this has not been done.

Shipowners who operate modern geared turbine, or turbo-electric ships of over 15,000 total horsepower may express doubts when informed of the very low fuel consumption of Diesel-electric-driven submarine tenders. At almost top ship speed, the daily fuel consumption for all purposes is under 58 long tons, or 430 bbl. (one ton of Navy Diesel oil equals 7.4 bbl.). Exact figures are given later.

The remarkable economy and resultant extra carrying capacity which a similarly powered merchant ship would thus be given can be understood, because the most modern and efficient geared-turbine installation of the same aggregate power would burn about 100 tons per diem of Bunker-C fuel at full load. This is equivalent to 645 bbl., as a ton of heavy fuel oil equals 6.45 bbl. (A turbo-electric steamship would burn nearly 110 tons of oil.) On a 20-day round voyage, this would mean a difference at sea of 840 tons, or a substantial saving in fuel to the advantage of Diesel-electric power. Compared with turbo-electric drive, there would be a fuel saving of approximately 1,100 tons, and in neither case does this include the saving in fresh water effected by the motorship, because the auxiliary heating boiler would require a comparatively small amount, as also would the closed cooling system for the Diesels. And in warm weather, heating would not be required, except for service water.

Twelve round voyages a year would result in an ability to carry a total of 10,000 to 13,000 tons additional profit-earning cargo, plus the very considerable fuel savings in port. Actually, the greater quantity of fuel per ton of Diesel oil referred to, plus the port fuel savings, should almost be sufficient to offset the extra cost per ton, especially if the wise shipowner purchases his Diesel fuel by the ton, instead of by the barrel, as do European motorship owners.

In this article, we are dealing mainly with the *Proteus* as being typical of the other ships, some of which have had the two big cranes aft removed. These seven submarine tenders are named as follows: *Fulton, Sperry, Proteus, Orion, Howard W. Gilmore, Bushnell* and *Nereus*. With the exception of the *Sperry*, all have d.c. electric propulsion, the *Sperry* having a.c. equipment. Certain advantages of the a.c. drive have become apparent from experience, and probably will result in any future tenders being equipped with this system.

The welded and partly riveted hull of the *Proteus* has very handsome lines and if a similar hull were fitted with superstructure and interior, as required by a passenger-cargo liner, she would make a fine looking craft. As previously mentioned, there are two 33-foot-long engine rooms. The forward machinery compartment contains four Model 16-248 General Motors-Cleveland Diesel two-cycle engines of 1,600 maximum bhp. each at 750 rpm., with sixteen 8½ in. x 10½ in. V-arranged cylinders. On the tenders having d.c. electric propulsion, each of the four main engines in the forward room is coupled to an electric generator of 1,125 kw. and the combined current goes to four motors that are reduction-geared to the starboard 13¼ in. diameter propeller shaft. Each of these 550 volt motors can deliver 1,440 hp. at 750 rpm., or an aggregate of 5,760 hp. per shaft when under full load. As this is duplicated in the after engine room on the port propeller shaft, there is a total of 11,520 hp. available at the reduction gear for propulsion.

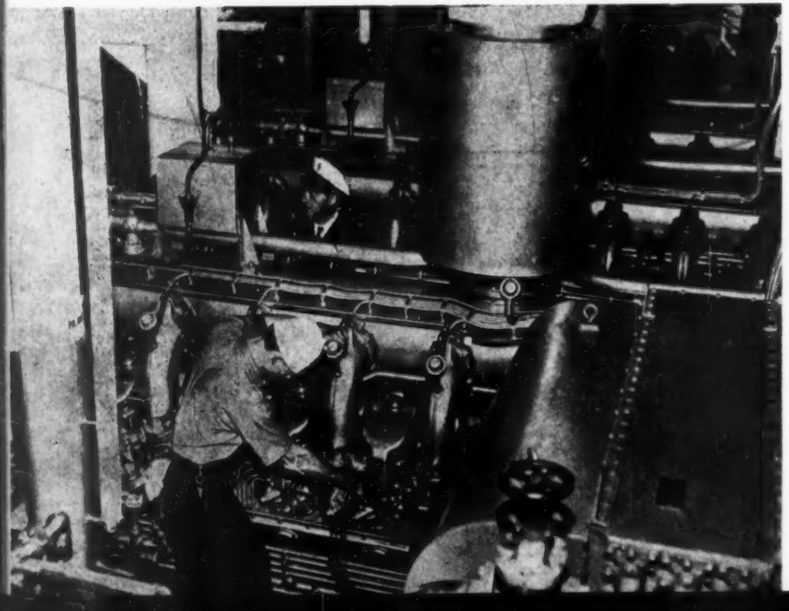
For long distance operation, a cruising output of 1,250 bhp. per engine is usually adopted with these ships. By means of careful checking, the engineers of the *Proteus* have found that the most economical fuel curve for the ship is obtained when 4,800 bhp. is being developed with six main engines running and the twin propellers at 68 rpm., instead of 130, because only 28 gal. of fuel per ship-mile are consumed. This is a remarkable figure and could not be approached by the most efficient turbo-electric-propelled vessel of her power, speed and dimensions.

Also in the forward engine room are two 12-cylinder Model 12-248 two-cycle, 750 bhp., 500 kw., GM-Cleveland Diesel generator sets arranged on the port side, with their control boards on a flat just forward. These are for auxiliary power. The main panel for the propulsion units is on the starboard side of the same flat. Other equipment consists of the large motor-generator set, four air compressors of 30 cu. ft. at 150 lbs., bilge, fire, service, circulating fuel and lube oil pumps, strainers, filters and two centrifuges—one for fuel and the other for lube oil.

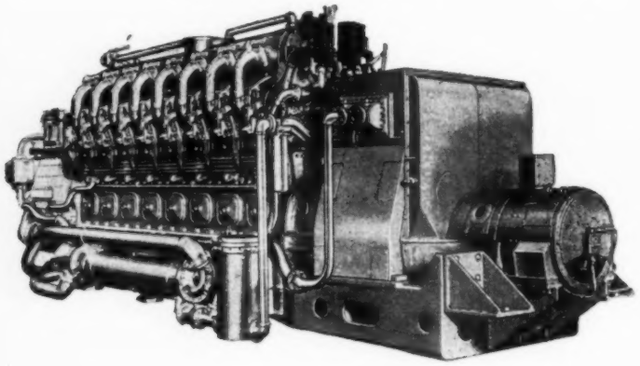
In the after engine room there are four more 1,600 bhp. GM-Cleveland Diesel generating sets for providing propulsion power to the port propeller. The features such as the main control board, coolers, centrifuges, pumps, etc. to be found in the forward compartment are duplicated here.

The installation of auxiliary Diesel generators differs, however—on some of the seven mother ships. For instance, the *Proteus, Nereus* and *Sperry* each have four auxiliary units of 500 kw., and one of 60 kw., whereas the *Bushnell, Howard W. Gilmore* and *Orion* have three 500 kw. units, one 250 kw. unit and one 60 kw. unit. In a separate compartment on a higher level of the *Proteus* there is a 90 bhp. Diesel engine turning 1200 rpm. and driving an emergency generator to provide emergency power for vital auxiliary circuits, even if both main engine rooms are flooded or badly damaged. A much larger engine room staff than would be needed by a merchant vessel of her size is carried on the *Proteus*. Altogether, 12 men per watch are in the after engine room, and 11 are in the forward compartment. With a passenger-cargo liner of similar power, this probably could be cut down to six men per watch, especially if all engines were installed in one compartment.

After engine room of the "Proteus."



Eight of these 1600 hp General Motors Diesels supply propulsion power for the "Proteus"



The fuel capacity of the *Proteus* is 1,200,000 gal. (3,760 tons) of Diesel oil, plus 77,000 gal. (248 tons) of lube oil. There also is tank capacity for 255 tons of drinking water, and about 240 tons of boiler and engine cooling water. The distilled water supply for submarine storage batteries is 12,000 gal.

According to data prepared by Lt. Comdr. P. E. Pontius, a former engineer officer of the *Proteus*, the following results were figured when the ship had not been dry-docked for bottom cleaning for nine months:

With eight main engines running and the two propellers receiving 7,160 kw. and turning at 122 rpm. (top revs. are 130 pm.), the ship's speed was 17.2 knots with a mean draft of 21 ft. 10 in. and with a displacement of 15,000 tons. (The top propulsion load is 8,808 kw.) The fuel consumption was 740 gal., or a little over 17½ bbl. per hour. When making 15.8 knots with six main engines in operation, the power developed at the propellers was 5,370 kw. at 112 rpm., and the consumption dropped to 620 gal. (15 bbl.)

With only one of the eight main engines running and furnishing 1190 kw. to one propeller at 72 rpm., a speed of 10.2 knots was obtained on a fuel consumption of 275 gal. (6.54 bbl.) per hour.

The engine room records show full power runs, with the ship at a displacement of 16,000 tons, attaining a speed of 17.1 knots.

Other records show a speed of 17.9 knots: one 24-hr. run averaged a speed of 16.4 knots and a fuel consumption of 17,914 gal. (426½ bbl.); another day's run gave 15.5 to 16.6 knots on a fuel consumption of 17,136 gal., and another 16.4 knots on 17,650 gal. of fuel. When cruising at 11.7 knots for 24 hours, and with two auxiliary Diesels operating at about 70% load, the total fuel consumption was only 7,800 gal. It will be noticed in the comparison in the table below that, with the a.c. drive, there is a very important saving in weight over d.c. machinery. Speed reduction is provided between the engine and motors, eliminating any need for reduction gears. This factor enables the engines to be operated constantly at higher speed and permits of lightweight design, while the propellers can be turned at lower speeds consistent with higher propeller efficiency. The first cost of a.c. drive is lower than with d.c. installation, which should be borne in mind when shipowners are asking for estimates.

On the other hand, the a.c. arrangement does not have the operating flexibility of the d.c. design, for with the latter, the propeller speed can be adjusted independently of the speeds of the Diesel units.

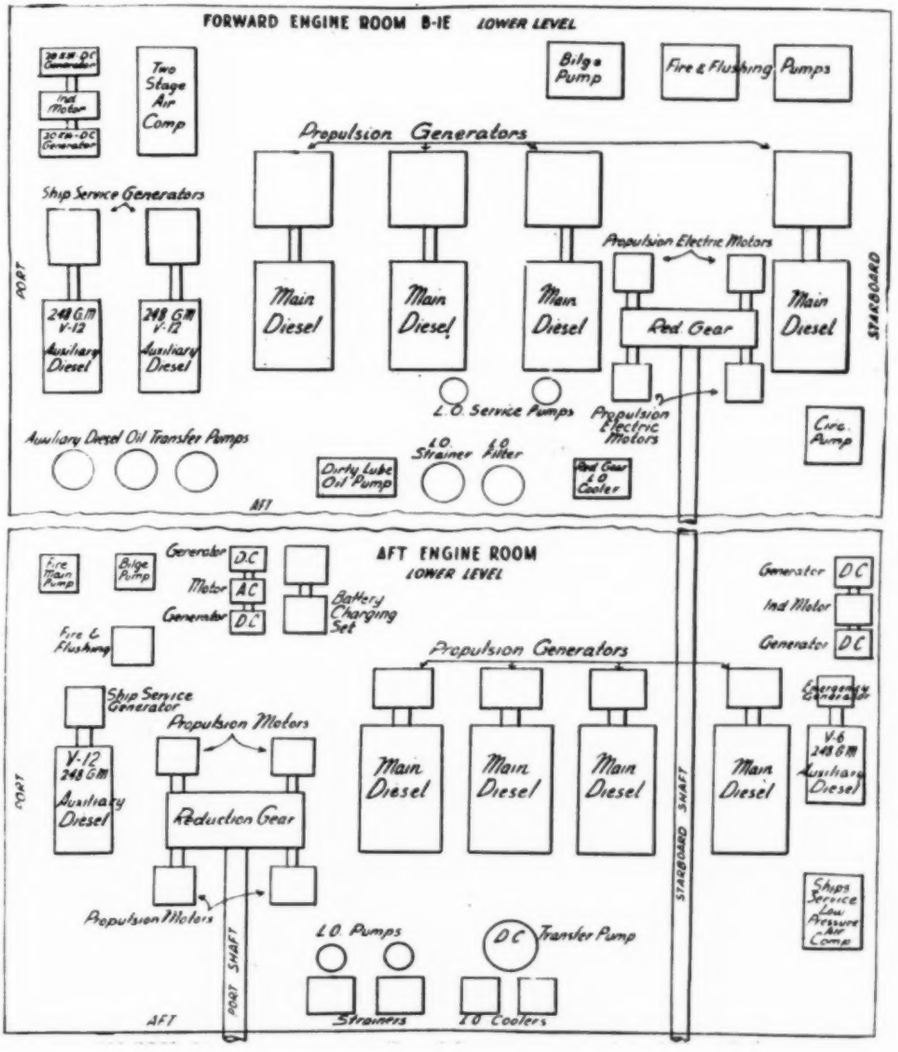
One important factor, in comparison with a steamship of the same power, is the weight of the machinery. This is as follows:

Submarine Tender PROTEUS with d.c. installation:	
Diesel Engines (Main)	321,400 lbs.
Generators	134,560 lbs.
Propelling Motors	134,560 lbs.
Reduction Gears	111,000 lbs.
Propeller Control	12,200 lbs.
Exciters and Starters	15,600 lbs.
Total	729,320 lbs. or 326 long tons

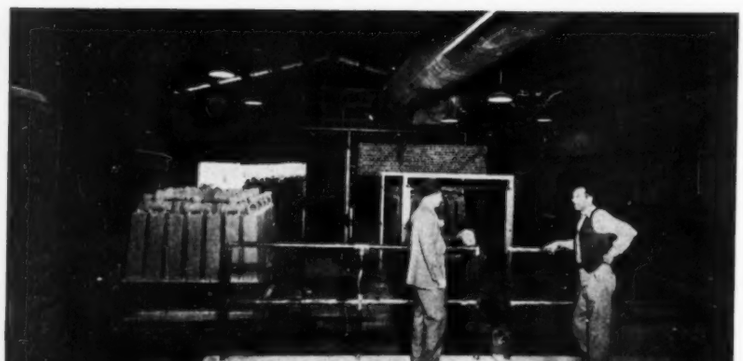
Submarine Tender SPERRY with a.c. installation:	
Diesel Engines (Main)	321,400 lbs.
Generators	82,200 lbs.
Propelling Motors	122,900 lbs.
Reduction Gears	0 0 lbs.
Propeller Control	46,000 lbs.
Exciters and Starters	31,140 lbs.
Total	603,640 lbs. or 269½ long tons

These weights are of particular interest because in a recent address before the Oil Industries Club in London, England, H. S. Humphreys, Superintendent-Engineer for a large fleet of tankers owned by the marine operating company of the Anglo-Iranian Oil Co., Ltd., stated that a modern steam turbine installation of about 7,000 shp. probably weighs about 200 to 250 tons lighter in steaming condition than a Diesel engine of the same power. He gave 900 long tons for turbine drive and 1,100 to 1,150 tons for direct-drive Diesel, but added that in powers about 7,000 shp., the Diesel-electric drive has to be considered. Comparison of Mr. Humphrey's weights for 7,000 shp. in steam turbine drive with the 11,520 shp. propulsion power of the *Proteus*, or the *Sperry*, shows a very great weight saving in favor of Diesel-electric drive.

Typical machinery layout for the seven navy submarine tenders.



DIESEL CLAY HAUL

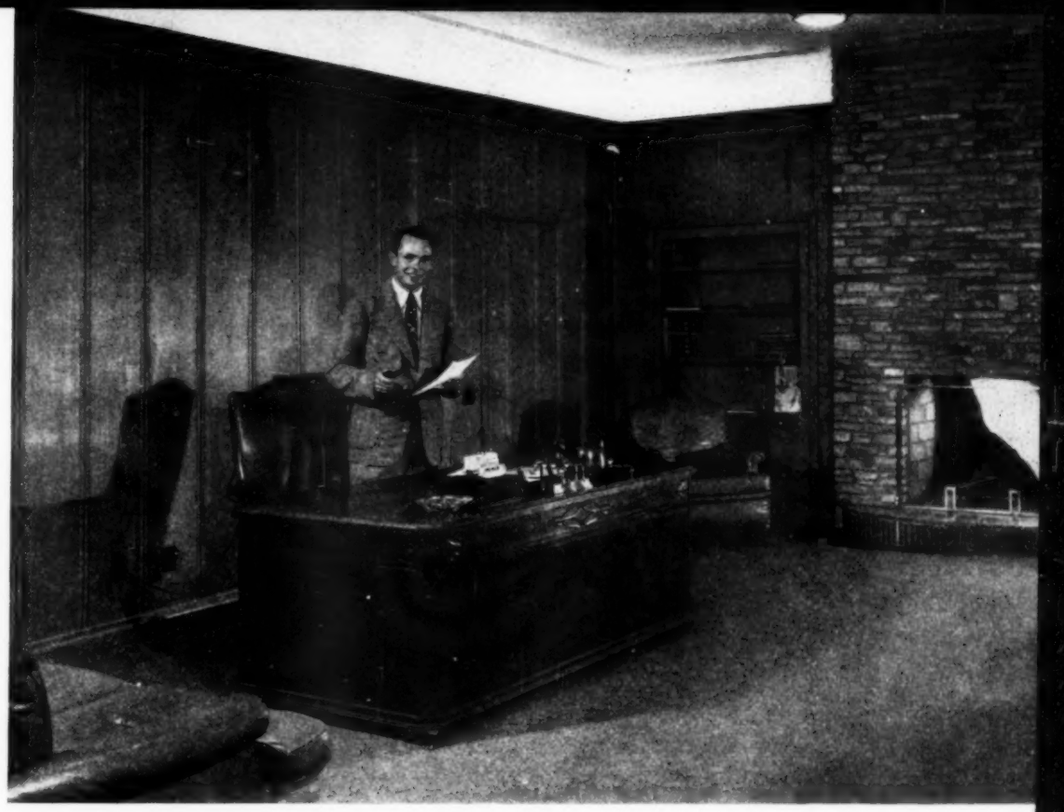


Autocar-Cummins 150 hp. Diesel tractor with 25-ton load of Clay enroute on 55-mile "Clay Haul" run from Alberhill to Pacific Clay Products plant in Santa Fe Springs. Fruehauf semi-trailer and trailer each has an 11-yard capacity. This tractor has traveled over 700,000 miles with five overhauls.

Charging end of 295-ft. Allied tunnel kiln for sewer pipe and other extruded clay products. One 7x9 foot kiln car load is completed each hour.

Dumping 12 tons of clay from rear Fruehauf trailer. Clay is conveyor-moved to a primary crusher, to a minus 1½-inch drypan, to a cross-feed belt, and finally dropped into a large storage bin. 5-ton cranes on a 1200-foot craneway, carrying 2-ton clamshell buckets, are used for subsequent handlings and clay blendings.

Confidence in the Caterpillar, John Deere, Hallett, Lister and Universal franchises must have run high when Shepherd Tractor & Equipment Company laid plans for the most pretentious distributorships we have ever been privileged to inspect. Here is a plant and personnel that reflect long range planning and the dynamic and genial personality of W. W. Shepherd, president, and his capable associates. Let Mr. Shepherd himself and Fred Burt tell you how this outstanding enterprise came about and describe some of its activities. The Editor.



W. W. Shepherd, President of Shepherd Tractor & Equipment Co. in his office.

SHEPHERD TRACTOR AND EQUIPMENT COMPANY'S NEW PLANT

By FRED M. BURT

EVERY facility necessary to supply the utmost in modern equipment, service and parts is embodied in the large and ultra-modern, new plant of Shepherd Tractor & Equipment Company, Caterpillar Distributors, in Los Angeles. Tens of thousands of different parts and units of equipment, from the largest "Caterpillar" Diesel engine down to the smallest nuts and bolts are kept in stock to supply customer requirements for the latest in Industrial & Marine Engines, Farm Machinery and Construction Equipment.

These include "Caterpillar" engines and other equipment; John Deere Farm Machinery; Hallett, Lister and Universal Diesel and gas engines; Radiomarine equipment; Trackson, Hyster and Athey construction equipment. Following is the interesting summarized history of Shepherd Tractor & Equipment Company, as given to the author by General Manager W. W. Shepherd, for DIESEL PROGRESS—"Willard E. Shepherd, my father, went to work for the Holt Manufacturing Co.—whose trade mark was "Caterpillar," at the age of fifteen, starting as a delivery boy. In a sixteen year period he came up through the shop, into the office, emerging as General Manager of the company in 1921.

"In 1924 he left the Holt Co. to become the Los Angeles distributor for Holt "Caterpillar" tractors. Our first place of business was located at First and Los Angeles Streets. In 1925 when the Holt and Best companies merged to form Caterpillar Tractor Co., Willard E. Shepherd, Inc., as our firm was then called, merged with E. I. Crook, Inc., to become Shepherd-Crook, Inc. In 1928 the organization went through an additional change, emerging as Shepherd Tractor & Equipment Co. Headquarters were situated at 514 West 12th St., where we had moved to consolidate with Crook Co. Needing larger quarters, in 1931 we moved to 150 West Jefferson St., where we remained until November 1946 when we transferred Los Angeles operations to our new location at Atlantic and Bandini Boulevards. Willard W. Shepherd, son of the founder, began work with the company in the summer of 1929, and from this time until 1935, when he graduated from Stanford University, worked for the company during vacation periods. In 1941, Mr. Shepherd, Sr., became actively engaged in Civil Air Patrol work, and shortly thereafter became involved in administration of the Used Construction Machinery Branch, War Production Board. Full management of the business was therefore taken over by Willard W. Shepherd at that time.

"We currently operate seven stores, as follows:

Los Angeles	Industrial, Farm, Marine.
Santa Ana	Industrial, Farm.
Covina	Industrial, Farm.
Lancaster	Industrial, Farm.
Castaic Junction	Industrial, Farm.
San Diego	Marine.
San Pedro	Marine.

with about 250 employees."

The thousand and one details of the efficiencies and niceties of the plant, yard, and office layouts, equipments and operations are graphically depicted in the drawing and pictures which appear on the following two pages.

The Shepherd "Caterpillar" territory is that part of Southern California which lies south of the "Ridge" (some miles north of Los Angeles), with extensive exports to Mexico. This diversified Diesel equipment is sold in quantities for roadwork, earth-moving, agriculture (particularly for the growing of citrus fruit, beans and grain), logging, mining; in the oil fields for pumping, drilling and other power uses; extensive marine uses including power in fishing boats, pleasure boats, tugboats, dredges, etc.

Shepherd Diesel Marine in Los Angeles, Terminal Island, and San Diego, is exclusive distributor for Hallett 8 and 18 hp. propulsion and auxiliary Diesels, for the territory from the Monterey County line, south to San Diego and in Lower California.

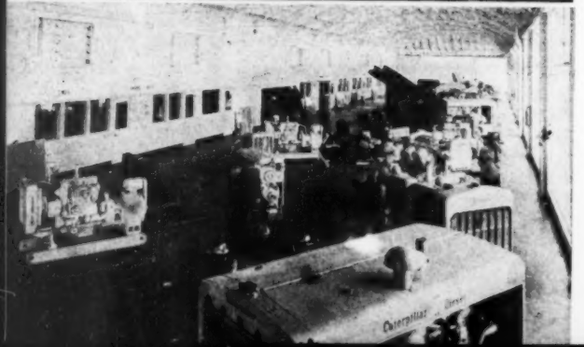
Plant Engineer G. G. Thomas, at his drawing table. Note murals on walls — many of these blown up from photographs of "Caterpillar" equipment in operation.

I.B.M. room, where International Business- Machines, key punch and tabulator equipment, is used for recording and calculating company costs, and many other records.

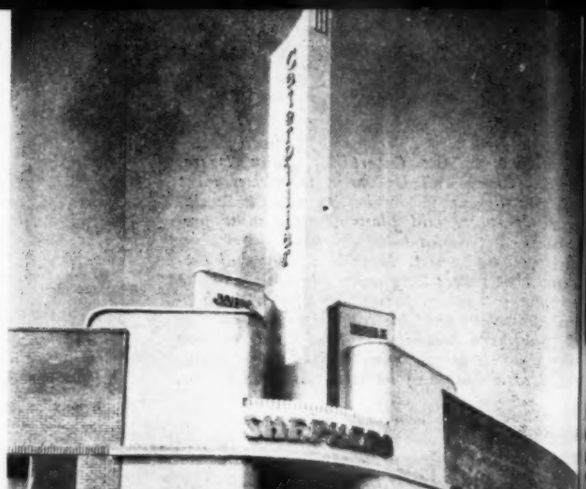
Large Diesel engine mounted on holding fixture for overhaul. Fixture revolves to place engine block in any desired position, and has a 4 ton capacity.

Parts department service counter, with rows of parts bin sections extending to background. Picture taken from smaller section of L-shaped showroom.

Literature and printing department, where all company printing of forms, stationery, bulletins, etc., takes place. Multilith machine in center of picture.



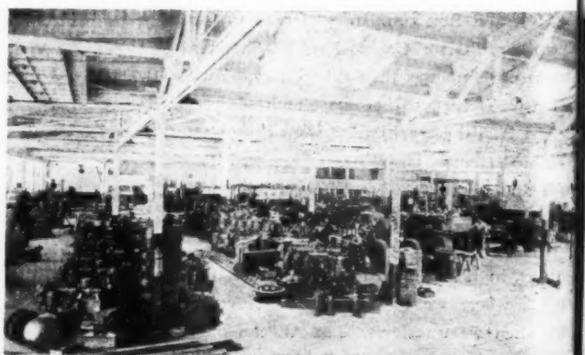
View looking north, in larger section of 12,720 sq. ft. 318 ft. x 40 ft. showroom, with long row of offices at left.



Main entrance to showroom and offices of Shepherd Tractor & Equipment Co., Los Angeles. The building is as streamlined as the organization it houses.

Upper of two views below: General Repair Dept. looking across the John Deere Farm machinery area, to the main aisle under craneway, with Caterpillar service, repair and assembly in background. Picture taken from Welding Dept.

Shepherd-designed and built parts truck being used to collect parts for an order. Note compartments for heavy (lower) and light (upper) parts, with clip holder for order sheets, and small compartments for bags of different sizes. Wheels are ball-bearing and rubber-tired.



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General Offices, Shepherd Tractor & Equipment Co.

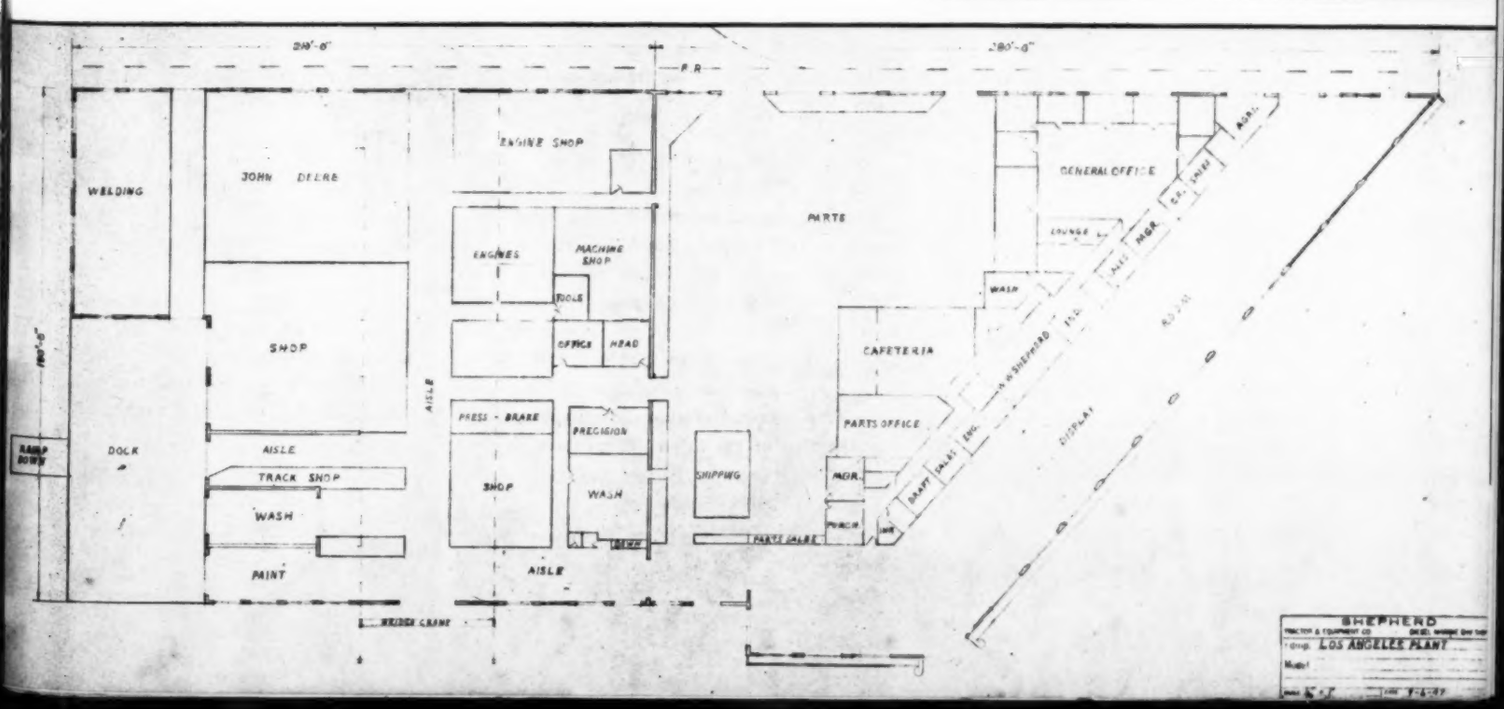
Parts bin sections containing many thousands of parts, each of which is numbered and with its location well indexed. Each unit of double rows of 6 or 7 bin sections, is numbered as shown. Then each bin section, down one side and back the other, is consecutively numbered. In each bin section are many, consecutively-numbered compartments. These can be made of any size desired with 1 in. vertical and 1½ in. horizontal adjustments. (A typical location numbering—19-1-7). When an order for parts is written up, it immediately goes into the Parts Dept. office for costing, and for listing of location. These are taken from the specific Parts Card in the Kardex file, and at the same time the disbursement is noted on the card, before it is taken from stock. Thus, at all times, the inventory card, which is also a case history on that part, has an absolutely accurate record of parts still available.

Precision Dept., repairing of magnetos, carburetors, fuel pumps, all injection equipment, a division of the General Repair Dept. The latest in injection testing equipment is installed to speed repair operation.

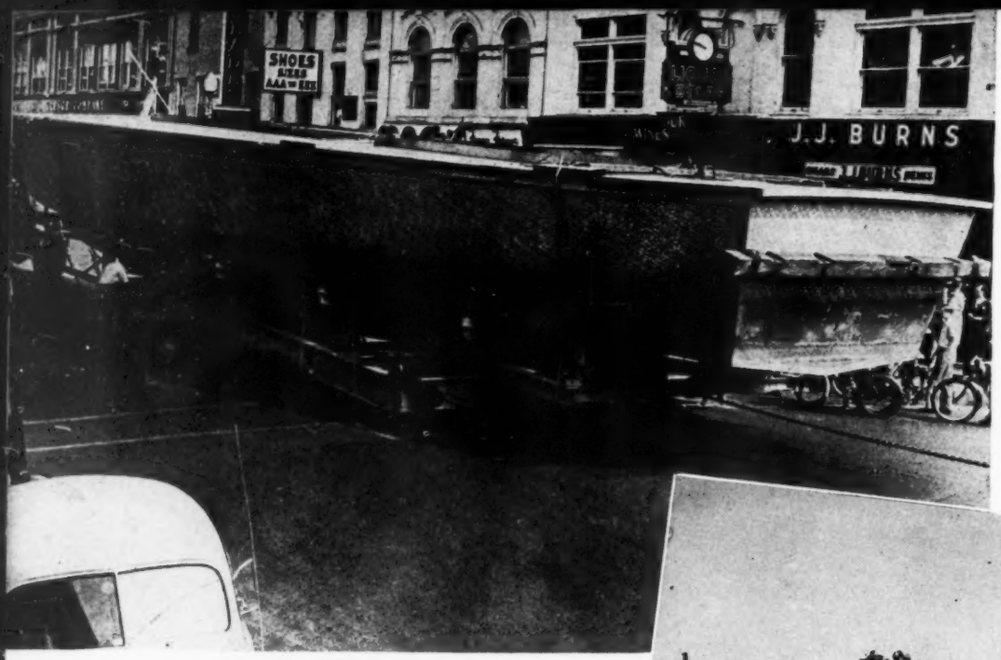
Parts Department main office, with Remington-Rand, Kardex files at right, which keep up-to-the-minute, perpetual inventories of more than 30,000 parts. The 30 cabinets of 16 drawers each, which contain 66 cards apiece, hold 31,680 cards. File clerks move from one cabinet to another, by riding the rubber-tired wheels of their chairs. Note the special, Shepherd-built table, with all-clear space beneath. At left are windows of the large parts department.

Floor plan of Los Angeles plant of Shepherd Tractor and Equipment Company. Display, sales, maintenance and overhaul are carried on in one building. New building was completed in November 1946. It represents the newest in plant design and stresses functional simplicity.

All heavier parts are stored and handled on wooden pallets and steel frameworks, of standardized sizes, using a 4-ton towmotor lift truck with an 8 ft. lift, and a Transstacker of 2500 lbs. capacity and 5 ft. lift. At left are Shepherd-built and -designed, parts trucks.



SUCCESSFUL PT-BOAT CONVERSION



80-ft. PT boat passes through the main street of Glens Falls on way to Lake George for conversion by the Lake George Marine Industries.

Transformed as "Ranger," PT now has sleek lines and 3 new General Motors Diesels for 20 knot speed. She will carry 150 passengers.

By GEORGE D. CROSSLEY

THE first new large boat to go into service on historical Lake George in a half century is being placed in service this season.

The new vessel is an 80 foot, 150 passenger luxuriously appointed day boat. It will ply the lake from Lake George village to Baldwin, thirty-six miles distant, winding among the 365 beautiful islands of the lake, giving to the thousands of tourists expected in the area this year, an opportunity for the first time to view this grandeur in comfort. This vessel is a PT in sport shirt. The hull was that of an original PT intended for use in the Pacific and obtained a year ago by the Lake George Marine Industries from Electric Boat Company of Bayonne, N. J. At the time of its purchase, few people believed that a PT could successfully be moved or converted to an inland body of water as far distant as Lake George in upper New York State. This, of course, was accomplished without sectionalizing the hull and the finished product made the gamble justified. The story of the moving of this vessel and its conversion is a marine engineering achievement of interest to engineer and layman alike, as the complete job was accomplished in less than a year.

In June, 1946, the hull strapped to its wartime cradle, was dropped into the water at Bayonne and floated from there up the Hudson and the Barge Canal to an isolated point near Fort Anne, where, with the aid of tractors and truck crane, it was beached and hauled overland to the shore of Lake George near Lake George village. In the course of the journey, the original superstructure was removed to permit clearance of underpasses, and with its arrival at the point for conversion, a Quonset hut of forty feet width and length exceeding 100 feet was mounted on stilts to house it. Power equipment was brought in and the hut converted to a dry dock.

George A. Granger of the village, an experienced boat builder, supervised the job of demolition and reconstruction and under his skilled guidance, a crew worked at full speed throughout the winter. The center of gravity was dropped four feet and the deck line modified, a 60 foot keel was added, provision made for new power plants, larger rudders, direct drive and complete new cabin and canopy. The deck was dropped two feet from the stern to a point at the fore of the cabin. From there to the bow, it graduated to within 9 inches of the original line.

The engine section was completely re-arranged to accommodate the three new 225 hp. General Motors Diesels, three tanks were installed to provide a fuel oil capacity of 375 gallons. Provisions were also made for septic tank fully automatic fire control system and forced hull ventilating system. Each of the three Diesels has a built-in Twin Disc 1.5 to 1 reduction gear.

The surface of the three rudders was increased from the original 4 to 5 feet of a PT to 9 feet each to provide greater control flexibility. The propellers are Federal Mogul 28 x 18. The angle of drive was changed necessitating the modification of the two outside struts which, like that of the center, are equipped with Goodrich Cutlass bearings.

The cabin and the canopy are 60 feet in length and finished in African mahogany throughout. The laminated carlings, like railings and accessories, were produced on the spot. Pilot controls are in the fore of the cabin with duplicate Hydra-Trol remote controls for the engi-

neer at a point just fore of the motors, which also is the location of completely modern toilet facilities. Duplicate instrument panels are also provided. They are equipped with Stewart Warner tachometers. The head clearance of the cabin is 7 feet tapering to 5 feet, 10 inches at the stern edge of the canopy. Individual seating is being installed. The chairs are of the Pullman type and will be movable, permitting flexibility of cabin arrangement.

The electrical system of the *Ranger* provides 110 volts AC for the amplifying system and 12 volts for lighting and engine starting. The two outboard generators provide 30 amps. at 12 volts through a 12 volt battery. The center generator provides 50 amps at 12 volts which supplies two 12 volt batteries. With the batteries as a source current is then fed through a rotary converter which provides the 110 volt AC current required by the electronic equipment. The public address system which utilizes this power has five built-in speakers—four are located within the cabin and one on deck for greater volume. Cabin lighting is accomplished by side lighting while lighting under the aft canopy is overhead. A Mile-Ray cabin-controlled searchlight is installed in addition to the regular navigation lights.

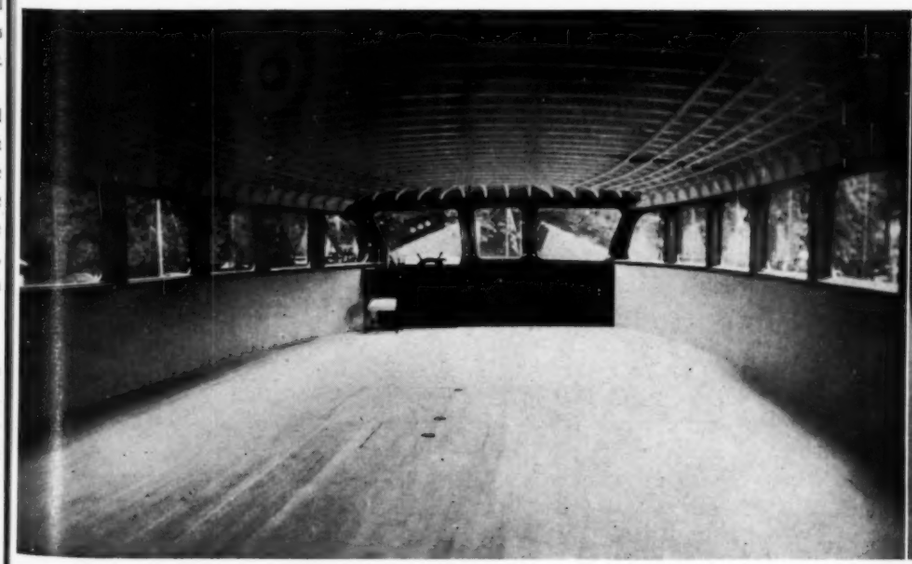
The *Ranger* has several safety features which are outstanding. A fully automatic CO_2 fire control system is installed throughout. Forced hold ventilation assures removal of oil fumes and engine heat. National Thermol ventilation is used. All duck canopy drops and upholstering are made of fire resistant material.

Two of the three 6-cylinder General Motors Diesels installed aboard "Ranger." Diesels develop 225 hp. each and drive three separate propellers through Twin Disc reduction gears.

The boat, as completely rebuilt by Lake George Marine Industries, has a 5 foot draft and 21 foot beam. Its speed will be in excess of 20 knots but by reason of lake conditions, will be held to a lower rate. However, even with reduced speed, the vessel will be able to make two complete trips around the lake a day, returning in time to cater to evening parties.

Whether or not additional boats of this size will be built by Lake George Marine Industries, a firm who until the building of this vessel, has specialized in the operation and maintenance of speed craft, will depend upon the need of additional boats of this type on Lake George. Already, many thousands of boat enthusiasts have come to inspect it during its construction and since its launching May 31 and indications are that it may set the style for lake day boats of the future.

Cabin of "Ranger" before installation of 150 pullman type chairs. Chairs will be movable to permit varying seating arrangements.

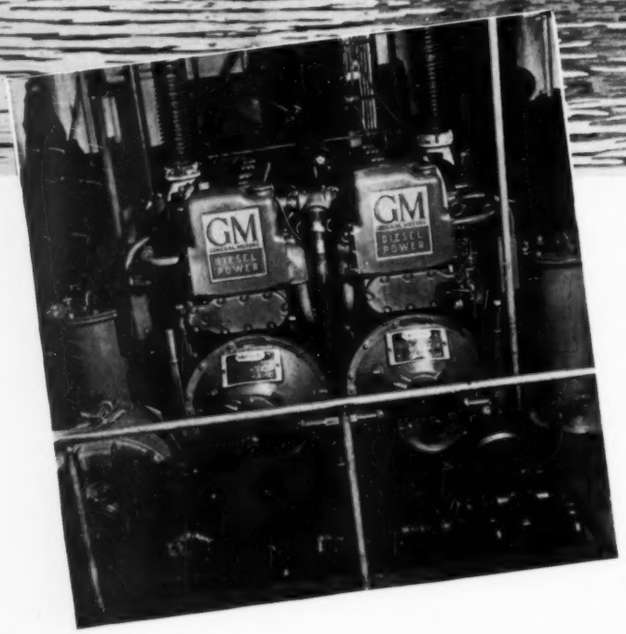


Control stand of the "Ranger" with Hydra-Trol controls provided for each Diesel.

Sternwheeler *Criss* handles four 100 ft. barges totaling 1600 tons.

DIESEL STERNWHEELER

A. V. CRISS



General Motors twin-six Diesel drives stern wheel with a 70:1 reduction at 24 rpm.

THE 60 foot sternwheeler *A. V. Criss* with her gravel loaded barges in tow has long been a familiar and impressive sight along the Ohio River, particularly in that section where the river forms a natural boundary between the states of Ohio and West Virginia. Her owners, the Tri-State Materials Corporation, operate a dredging and crushing plant on Letart Island which is situated about 35 miles upstream from the West Virginia river port of Point Pleasant. Currently the boat is engaged in towing service between the gravel plant and customer points as far distant as Charleston, West Virginia on the Kanawha River.

Several months ago the vessel's power plant was modernized by the installation of a 400 hp. General Motors Twin 6 Diesel engine which in turn has substantially increased her efficiency and pulling power. Since returning to service with the new Diesel plant aboard, the *Criss* has turned in an impressive record, logging an average speed, up and down river, loaded and light, of six miles per hour. The two engines of the Diesel Twin combination are located forward and are geared to a single shaft through a 5 to 1 reduction gear box. Reverse rotation is accomplished through hydraulically actuated clutches designed and engineered by General Motors as an integral part of the engine unit.

A 15½ ft. x 14 ft. split sternwheel is driven at 24 rpm. through chain drive and gear-box reduction from the main drive shaft. This represents a total speed reduction of 70 to 1 from engine to sternwheel.

In addition to propelling the vessel the General Motors Diesel operates all of the auxiliary equipment from front power take off arrangements connected to each of the two six cylinder units. The starboard engine is V belt connect to a 10 kw. DC generator which supplies electrical power for lighting. Attached to the port engine is a compressor that operates the air whistle, and booster pump for the hydraulic steering system. The hull is of steel construction having a 20 ft. beam and 4 ft. draft. Comfortable and up to date accommodations have been provided within the wooden superstructure for the boat's crew of eight, which includes 2 pilots, 4 deck hands, cook and relief man. A large dining hall and galley are located immediately aft of the engine room on the lower deck while the second deck is devoted entirely to sleeping quarters for the crew. Normally the *Criss* operates on a 24 hour schedule and makes her runs with four barges in tow, each of which measures 100 feet in length and has a load capacity of about 400 tons.

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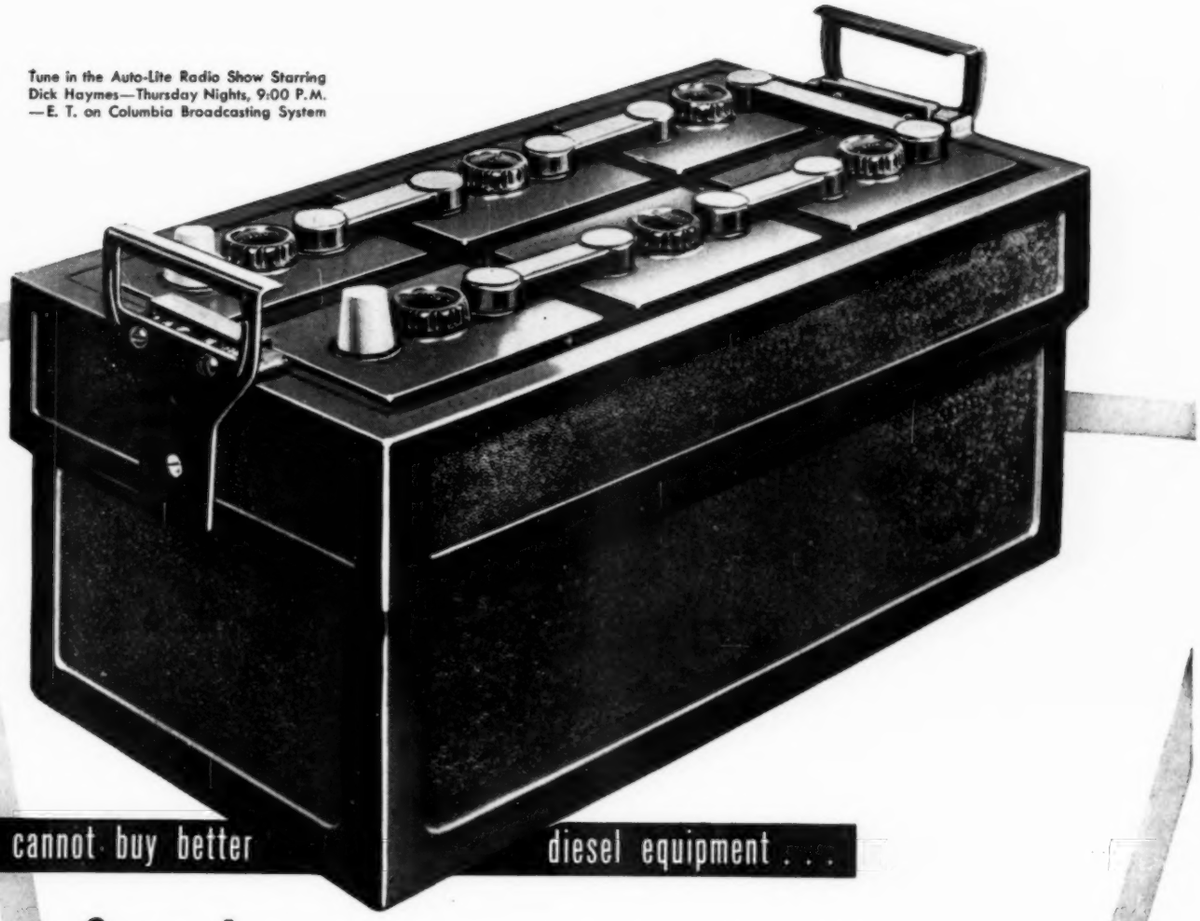
—E. T. on Columbia Broadcasting System



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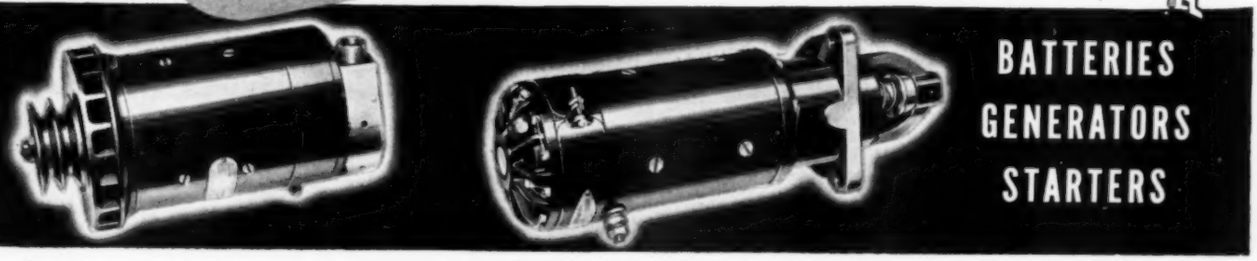

BATTERIES
GENERATORS
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Alco-G.E. 1500 hp road-switcher

NEW ALCO-GE ROAD SWITCHER

DESIGNED for switching, transfer or passenger operations, this 1500 hp. Alco-GE 115 ton, four-axle Diesel-electric is capable of hauling heavy loads at speeds up to 80 mph.

Incorporating a 1500 hp. turbosupercharged V-12 Diesel engine, the locomotive is 55 feet 5¾ inches overall length between knuckles with a maximum height of 14 feet 5 inches and a maximum width of 10 feet. Four electric traction motors, geared to each of the four driving axles, deliver a starting tractive effort at 25 per cent adhesion of 57,500 pounds. With 65 mph. gearing it has a continuous tractive effort of 42,500 pounds. This unit has capacity for 200 gallons of lubricating oil, 800 gallons of fuel oil, and 250 gallons of engine-cooling water. For train heating a steam generator can be installed in the rear hood with a capacity of 1600 pounds steam per hour at 200 psi. and a 800 gallon welded steel water tank attached to underside of underframe.

The Diesel engine is an Alco V-type and has 12 cylinders with 9 inch bore and 10½ inch stroke, supercharged with the G-E turbosupercharger. A four-cycle engine, it has two intake and two exhaust valves per cylinder. Construction includes a unit fuel injection system, water-cooled cylinder liners and heads, trunk-type oil-cooled pistons, forged steel connecting rods, seven-bearing crankshaft and welded cylinder block and base. Engine lubrication through a full-pressure system is provided by a gear-type pump integral with the engine, oil being supplied from 250 gallon reservoir in the engine base. Filters are of the full-flow type and the lubricating oil is cooled by a single-pass type cooler. Failure of the engine lubricating oil system automatically stops the engine.

Engine cooling is accomplished by a gear-driven centrifugal pump, integral with the Diesel engine, which circulates water through the engine, radiators and lubricating oil cooler.

The electric transmission system consists of the main generator, an amplidyne exciter, and four traction motors, one mounted on each of the four driving axles. A belt-driven auxiliary generator is also included to supply power for lighting, battery charging and control circuits and operates at constant voltage under control of a regulator.

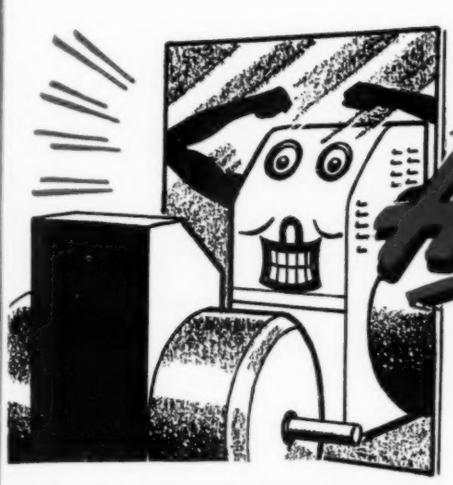
The 10-pole main generator, direct-connected to the Diesel engine is rated 1500 hp. at 1000 rpm. It is constructed with a single low-voltage, shunt-excited winding for amplidyne excitation. Using a special starting winding and current from the storage batteries, the main generator acts as a motor for starting the Diesel engine. The engine control equipment has been distributed between the control stand and the gage panel in the operator's cab. The contactor compartment forms the forward wall of the cab. The control stand, conveniently located at the left of the engineer's position in the cab, mounts the master controller, selector and reverser handles, air brake controls, air brake gages, load meter and speedometer, headlight and rear light switches and other control switches required.

The G-E electro-hydraulic power plant regulating system automatically governs the operation of the power plant to meet—insofar as is safe and possible—performance called for by the locomotive engineer. Preset engine speed is held constant, engine torque is limited, and generator demand is adjusted to suit the engine's ability to deliver power at any moment. The system comprises a tachometer generator and the governor, mounted on opposite ends of the engine. The tachometer generator is driven by the Diesel engine and its electrical output is directly proportional to the speed of the engine. The governor, energized by the tachometer generator, transforms the electrical impulse from the tachometer generator, transforms the electrical impulse from the tachometer generator into mechanical action to control the fuel racks of the Diesel engine. Through the amplidyne exciter, it also controls generator demand.

Engine protection safety features are built into the governing system. Overspeed protection is provided by an overspeed trip switch which automatically cuts off the fuel supply when the engine overspeeds. If engine lubricating oil pressure drops to the danger level, a short-circuiting switch drops the engine speed to idle. Similar type switches, functioning with the same end result, operate on occurrence of a ground in the main power circuit.

The underframe is of steel-plate construction, fabricated by electric welding. Truck center plates of cast steel are welded to the frame and equipped with hardened steel liners. Standard Type E top-operated swivel couplers, provided with side uncoupling levers, are housed in cast steel pockets at each end of the locomotive.

Each unit has two four-axle, swivel, swing-motion, pedestal-type motor trucks.



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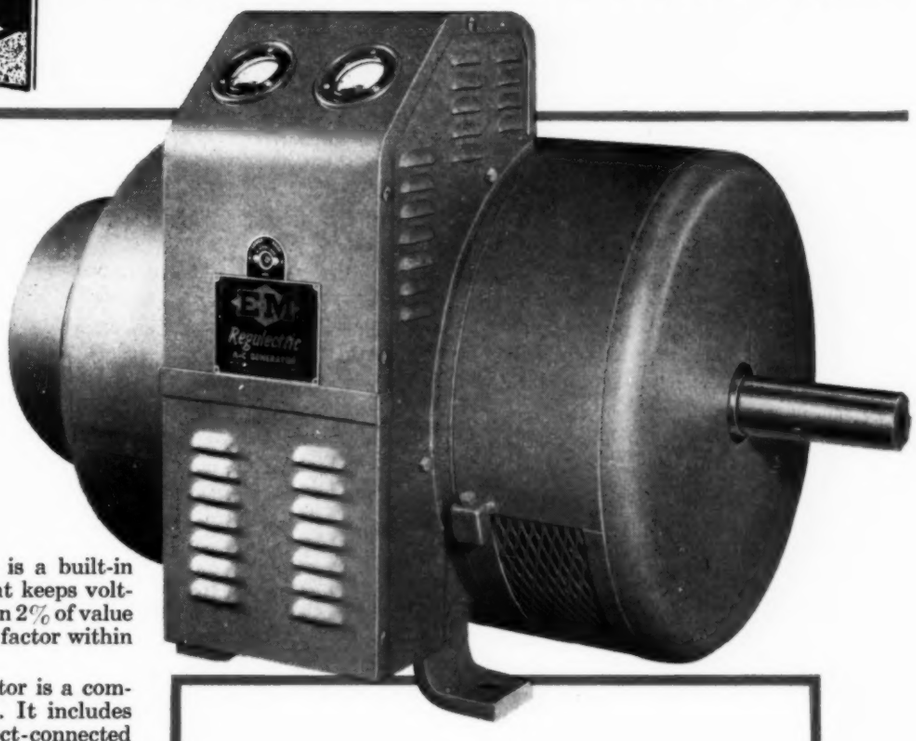

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E-M

DENNISON DISCUSSES MILLER PAPER ON SUPERCHARGING AND INTERNAL COOLING CYCL

Editor's Note: The following discussion by E. S. Dennison, Director of Research and Development, Elliott Company questions some of the statements made in R. E. Miller's paper "Supercharging and Internal Cooling Cycle for High Output." Mr. Miller's rebuttal follows Mr. Dennison's discussion. The curves referred to in the two statements appeared in the December issue of DIESEL PROGRESS along with Mr. Miller's paper. The suggestions made by Mr. Miller in his original paper have aroused great interest among Diesel designers and the discussion here is timely. The paper and the discussions were presented at the annual Oil and Gas Power Meeting.

THE proposal to close the intake valve before completion of the suction stroke, in order to cool the cylinder air charge, has the effect of materially decreasing the weight of air available for combustion. The case of the engine now under construction, mentioned by the author, may be taken as an example. The intake air is to be expanded within the cylinder from 32.7 psia to 19.7 psia, by early closure of the valve. Assuming adiabatic expansion, this pressure ratio corresponds to a loss of some 30 per cent of the available air per cycle. The weight of fuel which may be burned efficiently, and hence the power output, will consequently be diminished by similar percentages. These effects are the familiar result of operating an engine with severe intake throttling.

The author's purpose is to decrease the air temperature at the starting point of compression, and hence to decrease the arithmetic mean temperature of the cycle. The mean temperature is important only from the standpoint of cylinder cooling. The experience of engine designers is that cooling can be intensified by suitable design, and by vigorous circulation of the coolant, to permit extremely high rates of heat release in the cylinder. This trend is exemplified by aircraft engine design. Hence, engine builders now seek to attain high supercharge and combustion rates, and are able to meet the cooling requirements they arise. A deliberate cut of 30 per cent in air capacity, under these conditions, is not easy to justify.

In Fig. IV, it is implied by the P.V. diagram that suction may proceed at 18 psi gauge without throttling, to the point of cutoff, whereupon an adiabatic expansion begins instantly. Actually, valve closing is always gradual, and progressive throttling occurs through the valve. A throttling expansion produces no cooling. For this reason, the early cutoff will not affect cooling of the air to the extent estimated.

A supercharge pressure of 18 psi gauge, mentioned in the paper, is about the upper limit obtainable practically with a single stage centrifugal compressor. A supercharge of this character will enable an increase of engine rating in the ratio of 2:1 or somewhat more. This type of unit offers great possibilities for engine developments in the future.

Cooling the air after compression, as advocated by the author, is a most effective means of increasing the air charge and hence the load capacity of the engine.

Comment by Mr. Miller

The author does not attempt to establish definite maximum cycle mean temperatures, above which engines cannot be operated. Every engine builder has his own standard and no two designers agree upon MEP ratings. The paper deals with a method of supercharging which permits increasing the MIP without increasing the cycle mean temperature.

Hence, when the maximum permissible cycle mean temperature, whatever it may be, is reached in any engine supercharged with the conventional systems, a substantial increase in power output can be obtained with the dual pressure internally cooled supercharging system without increasing the cycle mean temperature. Developments in design, cooling systems or materials go on to raise the permissible temperature level, but this is not a subject of this paper.

Let us assume that Mr. Dennison's very efficiently cooled engine will carry 100 BMEP (120 MIP) non-supercharged and that the initial compression temperature is 680° R. We then read a T_m/T_1 ratio of 2.015 on the zero (atm. press.) line in Figure III. T_m is then $2.015 \times 680 = 1370°$ R. This we agree is the highest temperature the engine will stand. Mr. Dennison now maintains that due to the greater weight of air trapped in the cylinder with 18 lbs. supercharging pressure than with 6 lbs. intercooled pressure, more load can be carried at the higher pressure.

In Figure IV we see that the initial compression temperature at 18 lbs. supercharging pressure is 790° R. Since we must not exceed 1370° R. cycle mean temperature, the ratio T_m/T_1 will be 1.735 and the MIP 156 psi. (Figure 3.) However, if we intercool and expand to 5 psi. supercharging pressure and T_1 of 620° R., the T_m/T_1 ratio is 2.21 and the MIP 177 psi. This represents an increase of 16% in the BHP output of the engine though the weight of air has been reduced by 23%.

The effect of temperature becomes evident if we extrapolate T_1 and P_1 to what may be called absurd values, such as 1370° R. and 0 psi. gauge respectively. The weight of air will then be the same as when the pressure and temperature is 18 psig. and 790° R. According to Mr. Dennison, the weight of fuel which may be burned, hence the power output, is proportional to the weight of air in the cylinder. However, with P_1 and T_1 at 18 psig. and 790° R., we can carry 156 MIP at 1370° cycle mean temperature. But with P_1 and T_1 at 0 psig. and 1370° R., the ratio of T_m/T_1 is 1 and no fuel can be burned because the permissible cycle temperature is reached without adding heat. MIP is, therefore, zero.

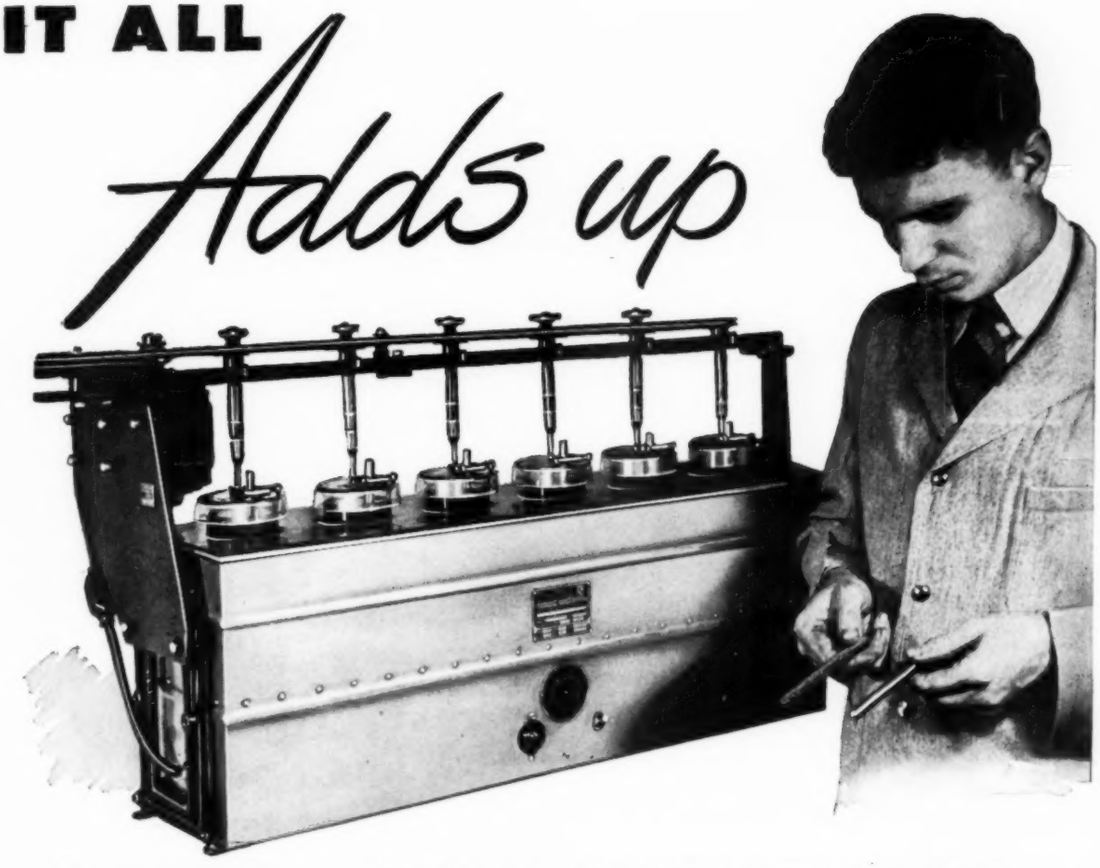
Regardless of pressure (P_1), an initial compression temperature (T_1) so high that the limiting cycle mean temperature, (or internal surface temperature) is reached without burning fuel, results in zero MIP. Zero weight of air regardless of temperature (T_1) results in zero MIP. Load carrying capacity is, therefore, a function of both charge pressure and charge temperature.

Mr. Dennison states that, "The mean temperature is important only from the standpoint of cylinder cooling." No matter how intensified the cooling and vigorous the circulation as the load is increased, a cycle mean temperature (or internal surface temperature) is finally reached, which cannot be exceeded for continuous, dependable operation. This is a very definite and real limit as designers well know. For most of our present day engines this limit is reached with non-supercharged engines at some 10% above the full load rating of 75 to 80 BMEP.

The pressure lines in Figure IV are schematic. Actual diagrams will, of course, show a drop below manifold pressure. This loss is simply made up by increasing the blower discharge pressure. Thus if it is desired to expand from 15 to 4 psi gauge, the blower discharge pressure is selected to give 15 lbs. pressure at the point of valve closing. This may require 16½ lbs.

. . . . *And now please turn to page 99* . . .

IT ALL *Adds up*



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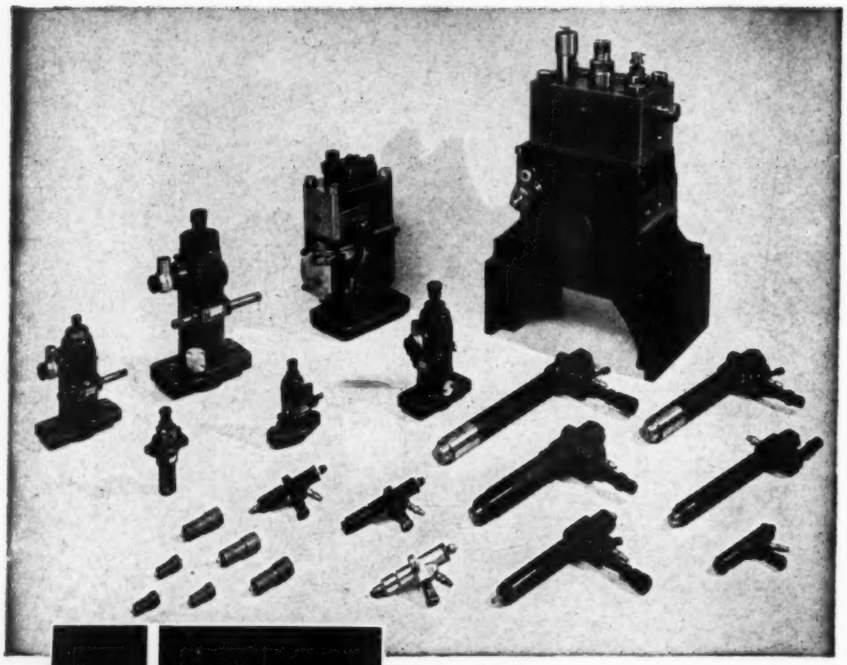

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America's most widely used nozzle tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors on bench or engine. Prevents costly delays and possible damage to engine. Standard or Navy-approved gauge. Ideal for testing hydraulic equipment. Write for bulletin.

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AIRCRAFT & DIESEL EQUIPMENT CORP.

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A.S.M.E. Annual Meeting December 1-5 In Atlantic City

THE 1947 Annual Meeting of The American Society of Mechanical Engineers will be held in Atlantic City, N. J., December 1-5. This will be only the third time in the Society's 68-year history that it has held the largest of its national gatherings outside of New York City. The 11th Annual Meeting, in 1890, was held in Richmond, Va., and the 60th, in 1939, was held in Philadelphia.

A desire to avoid the hotel congestion in New York which is expected to result from meetings of the United Nations was given as a chief reason for the change. The decision was reached following a vote of members. The Society's total membership is more than 22,000.

The Chalfonte and Haddon Hall will be the Atlantic City headquarters hotels. They have guaranteed 2,700 rooms for the meeting. Usually the attendance totals about 6,000 but it is expected to exceed that figure greatly this year. Some 200 engineers, scientists and industrialists take part in the program consisting of five days of continuous technical day and evening sessions.

In 1948 the ASME expects to return to New York to hold the Annual Meeting at the Hotel Pennsylvania.

Nordberg Names New Vice Presidents

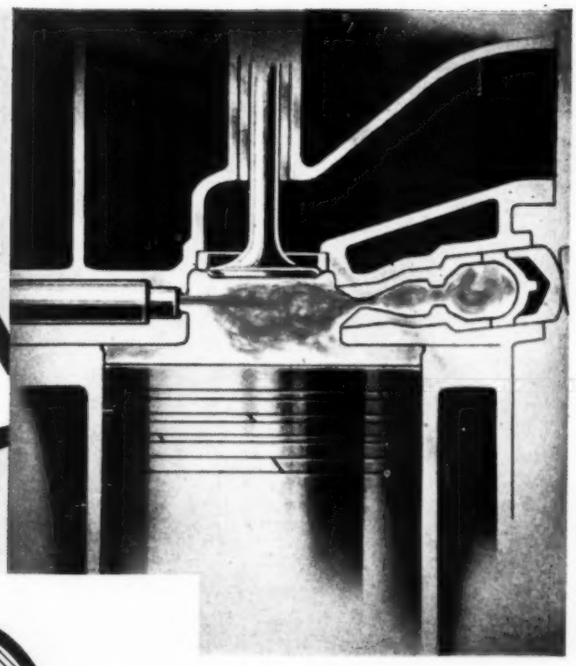
THE advancement to vice-president of four managers of various product divisions has recently been made by the Nordberg Manufacturing Company of Milwaukee. The four advanced to new positions are: R. W. Bayerlein—Heavy Machinery Division; D. A. Cheyette—Crusher Division; R. R. Shafter—Process Machinery Division; H. H. Talboys—Railway Equipment Division.

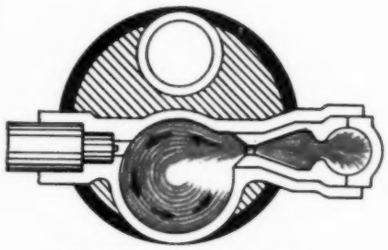
Auto-Lite Expands

NUMBER 28 to the fast growing manufacturing plants of The Electric Auto-Lite Company will soon be under construction at Hazleton, Pennsylvania, according to recent announcement by Royce G. Martin, President.

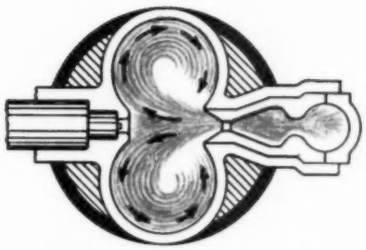
The new plant, covering hundreds of thousands of square feet, will be utilized to manufacture automotive wire and cable. Auto-Lite now manufactures wire and cable at Port Huron, Michigan, where a recent enlargement increased production 25 per cent, but additional customer requirements forced the erection of the new wire plant.

THIS MACHINE-MADE TORNADO MAKES DIESEL POWER MORE PROFITABLE





SINGLE LOBE TYPE



DOUBLE LOBE TYPE

(Left) Representative examples of the two different Lanova combustion chamber designs. Note the organized rotary stirring action that is developed to promote complete burning of fuel.

THE LANOVA COMBUSTION SYSTEM

Here is the "heart of the Diesel engine"—the Lanova Combustion System. At the instant pictured, you see the violent, blasting tornado set up when raw fuel is changed into throbbing power. Unlike the destructive forces of nature, this tornado is ***controlled and timed.*** It's designed to produce an organized rotary turbulence which picks up and thoroughly mixes the fuel with the air needed to insure complete combustion.

This ***controlled rotary turbulence,*** an exclusive feature of the Lanova Combustion System, makes a major contribution to the high efficiencies and excellent fuel economy of Lanova-type Diesels. It pays off in lower operating and maintenance costs.

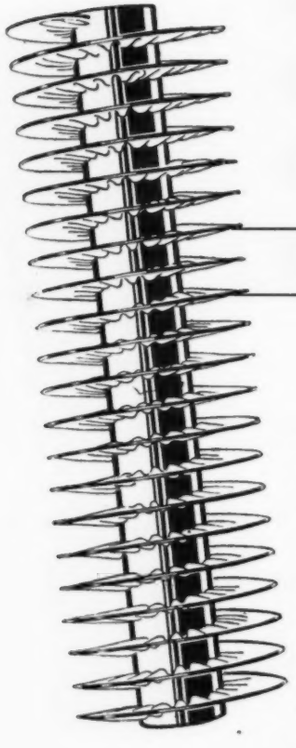
It will be worthwhile to investigate all the advantages of this improved combustion system which is offered by many leading engine builders in Diesels of their manufacture. For full information, WRITE TODAY. ATTENTION DEPT. P.

LANOVA CORPORATION

38-15 30th STREET LONG ISLAND CITY 1, N. Y.

LANOVA *makes Diesels purr*

AEROFIN



HIGH COOLING CAPACITY IN LIMITED SPACE

YOU can crowd a lot of cooling capacity into limited space with Aerofin fin-type coils. Installation can be made strictly according to Aerofin's accurate ratings. And perfect bonding and complete tinning assure maintenance of full ratings throughout the life of the installation. An Aerofin engineer is available to help you.

★ *Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.*

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NEW YORK CHICAGO CLEVELAND DETROIT
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Twin Disc Appointments

R. G. DeLong W. B. Gibson

THE appointments of Roger G. DeLong a Manager and of W. B. Gibson as Sales Manag of the Hydraulic Division of the Twin Di Clutch Company have been announced.

Mr. DeLong has been serving as both Acti Manager and Sales Manager of the Rockfo Division. Mr. Gibson has been Assistant Di trict Manager of the Eastern Territory.

Roger DeLong was graduated in 1938 fro Purdue University with a Bachelor of Scien degree in mechanical engineering. In 1940 h went with the Twin Disc Clutch Company a an installation engineer. Subsequent prom tions to Chief Installation Engineer, Assista Sales Manager, Sales Manager and acting D vision Manager, led to his present position Manager.

Wilton (Bill) Gibson, the new sales manage was a member of the Class of 1930 of th United States Military Academy. He joine the Twin Disc Clutch Company in 1940, joine the army in 1942 and left in 1945 after wi ning the Legion of Merit Medal.

Popular Diesel Lake Fisherman

Typical of the type of tug becoming increasingly popular in the Great Lakes fishing fleet is the Diesel engined "Jackie" owned by Lester Fisher of Marinette, Wisconsin. 42 ft. long, steel construction, she is built and powered for long runs and tough going. Power is a 3 cyl., 2 cycle, 82 hp. Gray Diesel with a 3:1 reduction gear.

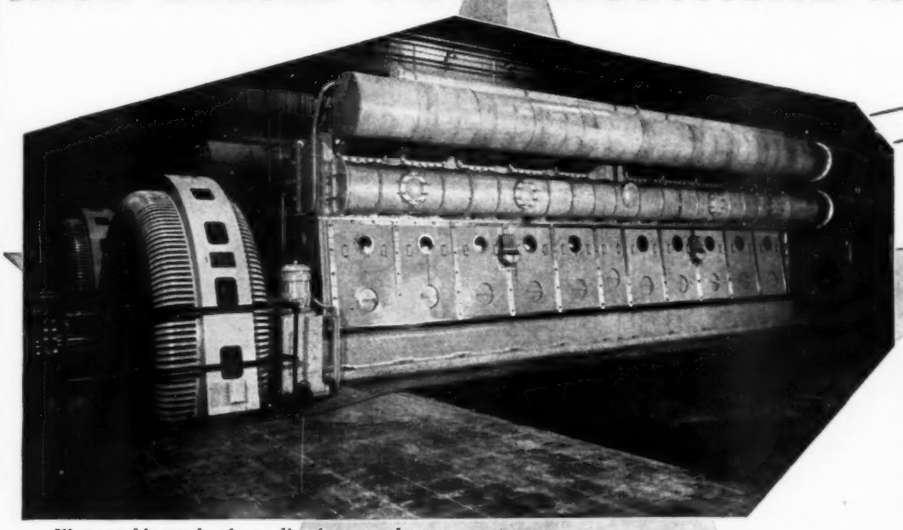
GENERAL MACHINERY

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

TRUE DIESEL PROGRESS...THE HAMILTON WAY

First diesel engine built in the U.S., 1898. First diesel-powered central station used this type engine, 1902.

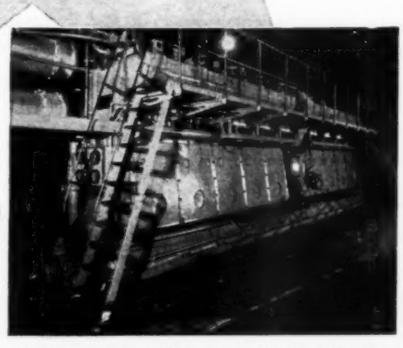


Exhaust side of 10-cylinder Hamilton Diesel.

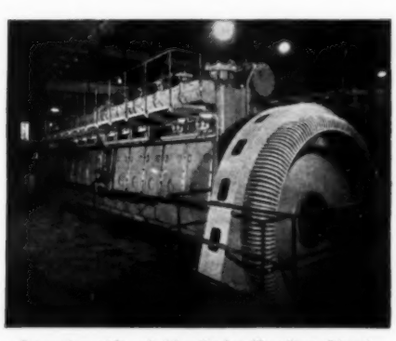
Illustrated is another large diesel power plant installation, using 47 21½" x 27½" cylinders, Hamiltons, of course. This plant grew from three 3-cylinder, two-cycle Hamilton Diesels—3,300 H.P.—to 47 cylinders, eight engines, 18,340 H.P. in less than five years. Efficiency of the floor crew is much higher because it deals with the same units regardless of the number of cylinders on any engine.

Night view of a large diesel plant with Hamilton Diesels.

Write Dept. F for Diesel Engine Catalog No. 500 and other literature covering diesels made by General Machinery Corporation. Please use your business letterhead and state your connection with the firm.



Operating side of 10-cylinder Hamilton Diesel.

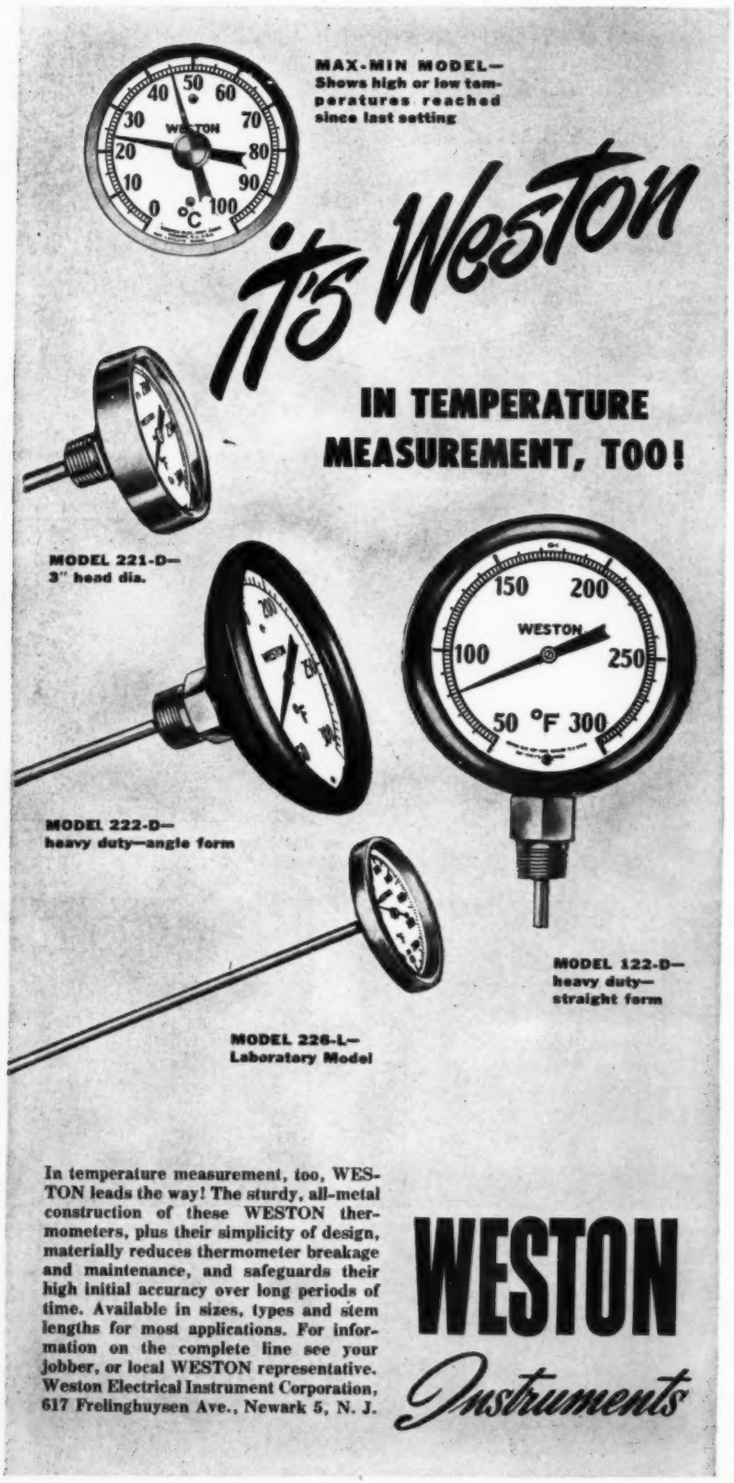


Operating side of 10-cylinder Hamilton Diesel.

SUBSIDIARIES: ★THE NILES TOOL WORKS COMPANY ★PUTNAM MACHINE COMPANY ★THE HOOVEN, OWENS, RENTSCHLER CO. ★THE HAMILTON PRESS AND MACHINERY CO. ★THE UNITED WELDING COMPANY

PRODUCTS: ★MACHINE TOOLS ★DIESEL AND STEAM ENGINES ★PRESSES ★CAN MAKING MACHINERY ★SPECIAL MACHINERY

Five Star Leadership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Shows high or low temperatures reached since last setting
it's Weston
IN TEMPERATURE MEASUREMENT, TOO!
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3" head dia.
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heavy duty—angle form
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In temperature measurement, too, WESTON leads the way! The sturdy, all-metal construction of these WESTON thermometers, plus their simplicity of design, materially reduces thermometer breakage and maintenance, and safeguards their high initial accuracy over long periods of time. Available in sizes, types and stem lengths for most applications. For information on the complete line see your jobber, or local WESTON representative. Weston Electrical Instrument Corporation, 617 Frelinghuysen Ave., Newark 5, N. J.
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National Supply Company Inaugurates Training Program

Dr. B. E. Warden

THE National Supply Company recently announced the start of a personnel training program for all its manufacturing plants, sales and engineering departments, and company stores—first company-wide training plan in National Supply history—with a noted educator in charge. A. E. Walker, president of National Supply, has announced appointment of Dr. B. E. Warden, former dean of students and director of student personnel at Carnegie Institute of Technology, as the company's first educational director, with headquarters in Pittsburgh.

Dr. Warden is nationally known in university administrative and teaching circles. A graduate of the University of Iowa in 1926, he later joined the Carnegie Institute faculty as assistant professor of economics.

In 1938 he was named adviser to men, the following year dean of men, and in 1940 organized the Division of Student Personnel and Welfare. He later organized the Naval Training program at San Pedro, receiving a letter of commendation.

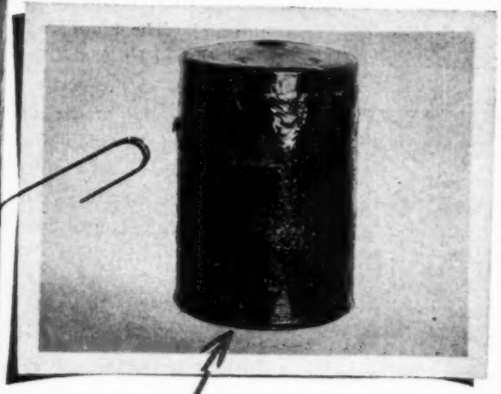
Sarco Company Changes Address

THE Sarco Company, Inc., manufacturers of steam specialties, recently announced the removal of their head offices to the Empire State Building, New York 1, N. Y., effective the first of September 1947.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised—more complete—indispensable. Convenient order coupon on page 100 this issue. Mail it today.

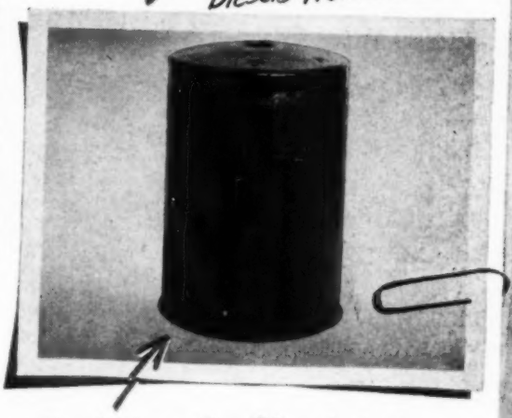
LUBE MEMO

How Joe stopped Filter Clogging



Joe says filters have gummed up like this after about 600 hours on oil he's been using

Joe says nothing but RPM Delo Oil in his Diesels from now on



Here's how the filter looked after 600 hours on RPM Delo Diesel Engine Lubricating Oil

Joe finds RPM Delo Oil keeps filters clean because:

1. It's compounded to resist oxidation and minimize sludge.
2. Its "detergent" cuts down sludge.
3. It remains stable in the presence of moisture.

DIESEL ENGINE RPM DELO LUBRICATING OIL

Set up trial on RPM Delo Oil Today!

STANDARD OF CALIFORNIA • San Francisco, Calif.
THE CALIFORNIA COMPANY • Denver, Colo.
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American Merchant Marine Conference October 15-17

WITH trade, travel and defense as its keynote, The American Merchant Marine Conference, sponsored by The Propeller Club of the United States, will be held in New York City at the Waldorf-Astoria, October 15, 16 and 17th, in conjunction with the organization's Twenty-first Annual Convention.

Hon. W. Averell Harriman, Secretary of Commerce, and former Ambassador to Russia, and to Great Britain, will be the Guest of Honor and Speaker at the Annual Banquet which will be held in the Grand Ballroom of the Waldorf-Astoria, Friday evening, October 17th. Hon. William O'Dwyer, Mayor of the City of New York, will introduce the guest speaker.

Problems affecting the maritime industry which have become extremely complicated since the war's end, will be discussed by twenty-four Panels which will convene for morning and afternoon sessions during the three-day conference. Conducted by outstanding leaders of the industry, these round table discussions are expected to concentrate the experience of the industry on vital problems affecting the future of the American Merchant Marine.

Vice Admiral William W. Smith, USN, Chairman of the United States Maritime Commission, will be the guest of honor and speaker at the American Merchant Marine Conference Luncheon, to be held in the Grand Ballroom of the Waldorf-Astoria on Thursday, October 16th. He will be introduced by Harmon Lewis, President of The Propeller Club, Port of New York and President of the Alcoa Steamship Company.

A special feature of the luncheon will be the presentation of awards to the winners in the American Newspaper Contest conducted last year by The Propeller Club. Cash prizes and the Propeller Club Plaque of Merit will be tendered to the twelve newsmen and photographers who professionally covered maritime events of outstanding importance during 1946. The presentations will be made by Lewis D. Parmelee, National President of The Propeller Club of the United States and President of the Atlantic Gulf and West Indies Steamship Company.

The main session of the Conference will be held immediately following the luncheon. The session will be opened by J. Lewis Luckenbach, Chairman of the American Merchant Marine Conference Committee and President of the American Bureau of Shipping, after which Admiral Smith will serve as presiding officer introducing the several speakers.

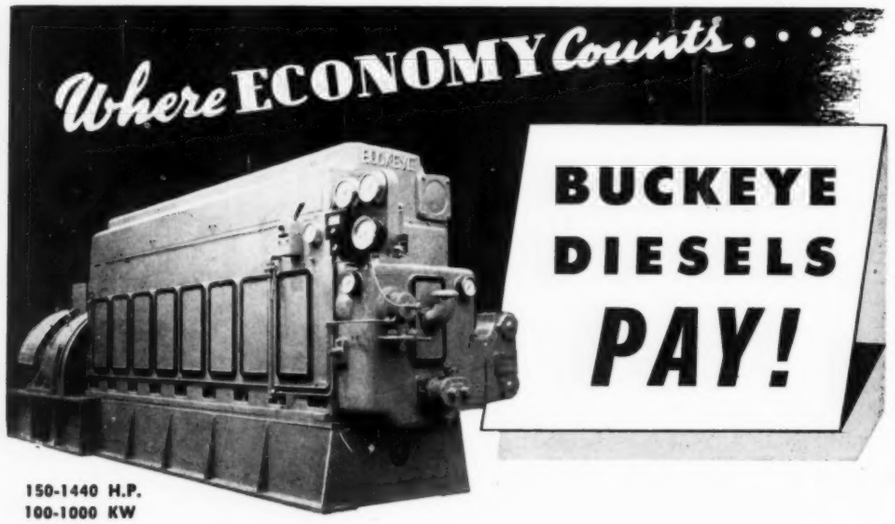
A panel on the use of Diesel engines in ocean-going vessels under the auspices of the Diesel Engine Manufacturers Association, will be held in the Jade Room of the Waldorf-Astoria Hotel Thursday, October 16th, 9:30 A.M.

The chairman will be E. J. Schwanhausser, vice president of Worthington Pump and Machinery Corp., with Gordon Lefebvre, president of Cooper-Bessemer Corp., acting as co-chairman.

A. P. Chalkley of London, editor of British Motorship and a recognized authority on world shipbuilding, will be the key speaker, taking as his topic, "Why Most Ocean-Going Vessels Built in Europe Are Diesel-Powered." Robert P. Ramsey, vice president of General Machinery Corp., will speak on "Diesel Engines: The Best Power for Ocean-Going Vessels."

"American Shipyards Can Build Diesel-Powered

. . . . *And now please turn to page 84* . . . .



150-1440 H.P.
100-1000 KW

BUCKEYE POWER = EXTRA PROFITS

Today's narrowed profit margins make low cost power more important than ever before as a logical source of extra profits. Ever since 1908 — in thousands of stationary and marine installations — owners and operators have learned that the name "Buckeye" on an engine means ECONOMICAL POWER.

Buckeye owners will tell you that their savings in power cost represent a worthwhile profit that was formerly labeled "Operating Expense."

BUCKEYE ECONOMY and DEPENDABILITY

Every feature of Buckeye design and construction has been developed to bring the highest standards of dependability and economy to users of Diesel power. For example, Buckeye valve areas are larger because there are no valve cages. This increases combustion efficiency by providing faster air flow and quicker expulsion of gases. Crankshaft and connecting rod bearings are reversible, shell-type, silver alloy — made by an exclusive Buckeye process — and will last, with proper care, for the life of the engine. These and many other features are responsible for the low cost, dependable operation of Buckeye Diesels.

Buckeye engines are appreciated most where the going is tough . . . the service twenty-four hours a day . . . and a low cost source of dependable power is required.

Our engineering staff is always at your service. No obligation—no cost. Just write.

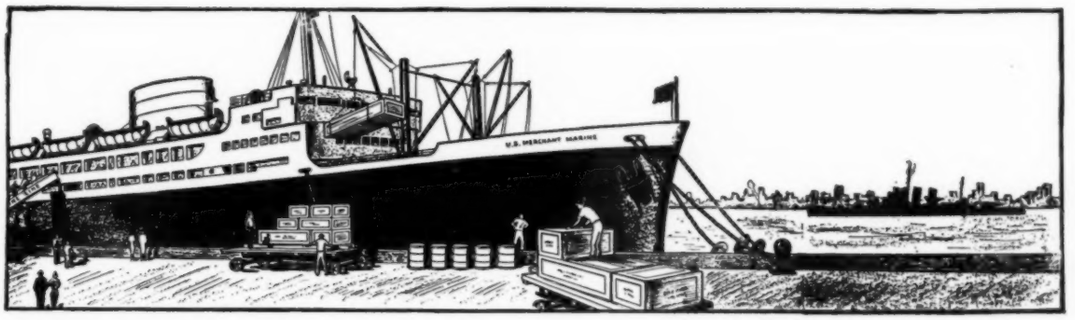
MARINE

"Be Profit-Wise and Dieselize with Buckeyes"

STATIONARY

Engine Builders Since 1908

THE BUCKEYE MACHINE CO.
LIMA . . . . . OHIO



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Radiomarine Corp. of America

L. D. PARMELEE
AGWI Steamship Lines, Inc.

HARRY W. PARSONS
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AGWI Steamship Lines, Inc.

JOHN G. PEW
Sun Shipbuilding & Dry Dock Company

HENRY H. REED
Insurance Co. of North America

JOHN D. REILLY
Todd Shipyards Corporation

H. HARRIS ROBSON
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T. A. SCOTT
Merritt-Chapman & Scott Corporation

H. GERRISH SMITH
Shipbuilders Council of America

ALBERT F. STOLL
Russell & Stoll Co.

V. J. SUDMAN
Black Diamond Steamship Corp.

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A. T. WOOD
Wilson Transit Company

The American Merchant Marine for Trade, Travel and Defense

★

THE American Merchant Marine Conference, sponsored by The Propeller Club of the United States in conjunction with its Twenty-first Annual Convention, will be held in New York, October 15, 16 and 17th, 1947.

The Conference theme will be "The American Merchant Marine for Trade, Travel and Defense." Problems of vital importance to the American Marine Industry growing out of the period of world reconstruction and the rehabilitation of our domestic and foreign trade will be presented and discussed by recognized authorities. The Conference will concentrate the experience and wisdom of outstanding leadership upon subjects of utmost importance affecting the future of the American Merchant Marine.

Panel Discussion meetings will be held on October 15. 16 and 17th; the Main Conference Session on Thursday afternoon, October 16th; Propeller Club Convention Session on Friday, October 17th; and on the evening of that date, the annual American Merchant Marine Conference Banquet.

The necessity for coordinated and constructive effort is more apparent today than ever before . . . Your help and participation are needed in this program to foster the best interests of the American Merchant Marine as an essential factor in the national defense and our economic welfare . . . Arrange now to attend the American Merchant Marine Conference and to take part in this important annual gathering of the American Marine Industry.

AMERICAN MERCHANT MARINE CONFERENCE

THE WALDORF-ASTORIA – NEW YORK

October 15, 16 and 17th, 1947

For Complete Details and Advance Program, Address

The Propeller Club of the United States

National Headquarters

17 Battery Place - New York 4, N. Y.

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The Propeller Club of the United States

J. LEWIS LUCKENBACH, Chairman
American Merchant Marine Conference

LEWIS D. PARMELEE, National President
The Propeller Club of the United States

HARMON LEWIS, Chairman
Conference Committees
Port of New York

Merchant Marine Conference *Continued*

Vessels" will be the topic of an address by J. H. G. McConechy, chief engineer of Sun Shipbuilding & Dry Dock Company. Robert E. Friend, president of Nordberg Mfg. Co., will tell of "Diesel Engines in Cargo Vessels During the War." Adm. Samuel Murray Robinson, Administrator of Webb Institute of Naval Architecture will have as his subject, "Observations on Development of the Diesel Engine in the Marine Field."

Society of Naval Architects and Marine Engineers to Meet November 12-15

THE 55th Annual Meeting of the Society of Naval Architects and Marine Engineers will be held at the Waldorf-Astoria, New York City, on November 12-15, 1947. A series of nine papers will be presented during the meeting.

The Annual Banquet will be held on Friday evening, November 14, at 7:30 p.m. at which time Vice Admiral Edward L. Cochrane, USN, President of the Society, will preside. On Saturday morning, November 15, the Society will visit the United States Merchant Marine Academy at Kings Point, Long Island, N. Y., at which time a plaque in memory of the late Vice Admiral Howard L. Vickery, USN, will be unveiled. The Society has recently presented this plaque to the Academy for installation at the Vickery Gate. The Plaque honors Admiral Vickery for his "outstanding success in directing the construction of merchant vessels in World War II."

The festivities will close with the very popular Dinner Dance of the Society in the Grand Ballroom of the Waldorf-Astoria on Saturday evening, November 15.

SLOW-RUNNING . . .
VIBRATIONLESS
. . . for lasting economy and endurance

Low speed means less wear . . . longer life. Like a tireless hourglass, Fulton Diesels run s-l-o-w-l-y, steadily, smoothly year after year. Compare speeds before you choose a Diesel . . . remember the lower the speed, the lower your operating and maintenance costs will be.

- Types KS and KSD develop 1500 to 2900 HP at only 225 RPM.
- Types BGS and BGSD develop 800 to 1800 HP at only 277 RPM.

FULTON DIESELS
DELIVER MORE POWER FOR LESS MONEY

FULTON IRON WORKS COMPANY
ST. LOUIS 14, MISSOURI

Detroit Diesel Names West Coast Sales Engineers

TWO new appointments to west coast sales positions were announced recently by V. G. Genn, General Sales Manager of the Detroit Diesel Engine Division, General Motors Corporation.

Lauren H. Wells has been assigned as sales engineer for the northern west coast zone and will direct industrial, marine and petroleum distributors sales in that area. His territory will include Washington, Oregon and the northern part of Idaho. Mr. Wells joined the General Motors organization in 1937 and since that time has been continually associated with various phases of the Diesel engineering work.

L. H. Wells

V. Hansen

Victor Hansen will take over the southern west coast zone in a similar capacity with distributors in California, Arizona, and eastern Nevada coming under his jurisdiction. Mr. Hansen came to Detroit Diesel from General Motors Overseas Operations in October, 1946, bringing with him a 20 year record of continuous GM service. During the war he acted as civilian technical advisor to the armed forces and was assigned to advanced base duty in almost every war theatre. Mr. Hansen will make his headquarters at Oakland, California.

LION Naturalube D.H.D. OIL

RESISTS SLUDGING • REMOVES CARBON

More Power — Lower Operating Cost

Naturalube D. H. D. Oil is refined from a basically different crude oil that has amazing natural properties. Because of them, D. H. D. is able to loosen and remove hard carbon *naturally*. It has greater natural ability to penetrate to all parts of an engine. It has greater natural ability to *cling* to those parts. You get the constant wear-saving protection of a naturally tougher oil film. And D. H. D. is non-corrosive — safe!

In addition, Naturalube D. H. D. is specially reinforced to give greater resistance to the formation of power-destroying sludge and lacquer.

D. H. D. gives you these big advantages in Diesel operation: less wear, fewer repairs, more power from a cleaner engine, and lower operating and maintenance costs. Leading engine manufacturers accept Naturalube D. H. D. as a superior lubricant.

☆ ☆ ☆

For complete information, ask your Naturalube Distributor or write direct to Lion Oil Company, El Dorado, Ark.

The Naturalube Guarantee —

If you don't believe Naturalube D. H. D. is the best oil you have ever used, Lion Oil Company will give you your money back.

LION OIL COMPANY — LION — EL DORADO, ARKANSAS

New Vice Presidents for Borg-Warner

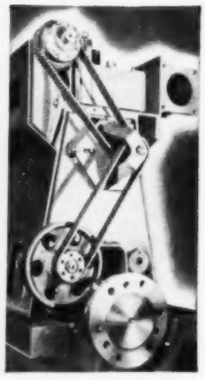
THE election of two new Vice Presidents and the re-election of other officers of the Mechanics Universal Joint Division of Borg-Warner Corporation were announced recently by C. S. Davis, President of Borg-Warner.

C. E. Palmer, former Works Manager, was named Vice President in Charge of Manufacturing for both of the division's plants—the one in operation at Rockford, Ill., and the one now under construction in Memphis, Tenn.

The other newly elected Vice President is Fred M. Potgieter, who will have charge of truck, agricultural implement, industrial and aviation sales.

G. C. Gridley was re-elected President and General Manager. R. R. Rolph was re-elected Vice President in Charge of Automotive Sales.

PERFORMANCE
PROVES SOUND ENGINEERING OF LINK-BELT CHAIN DRIVES



Link-Belt Silverlink Roller Chain overhead camshaft drive. Link-Belt Silverstreak Silent Chain Drive operates the water pump. There is a correct Link-Belt chain for every application.

The trend of design in modern Diesel engines has been strongly influenced by the distinctive qualities of such important basic elements as Link-Belt silent and roller chain for camshaft, generator, fuel pump, water pump, governor drives, etc. These efficient, dependable and durable drives represent the accumulated knowledge of more than 70 years of pioneering in development and application of chain to every power transmission purpose. Link-Belt has worked together with designers, builders and operators of Diesel engines from the beginning, and Link-Belt engineers have contributed many basic ideas now employed by builders of internal combustion engines.

Call Link-Belt engine specialists for aid in every phase of chain application.

Two Link-Belt Silverstreak Silent Chains driving overhead camshaft on Joshua Hendy Series 20 Diesel Engine. L-B Duplex Type chain used on lower sprocket. Again, the correct chain for the application.

LINK-BELT COMPANY
Detroit 4, Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 10,597

LINK-BELT
Diesel
CHAIN DRIVES
SILENT AND ROLLER TYPES

Nordberg Appoints E. C. Schum

E. C. Schum

THE Nordberg Mfg. Company recently announced the appointment of E. C. Schum as District Manager with headquarters at Kansas City, Missouri. Following his graduation at Cornell University in 1935 where he received a degree in Mechanical Engineering, Mr. Schum entered the Engineering Department of Nordberg and was engaged in Diesel engine design and test. In 1939 he transferred to the Sales Department where he remained until he entered military service in 1942. As a commissioned naval officer he was attached to the Internal Combustion Engine Section of the Bureau of Ships. Following his release from service, Mr. Schum again returned to Nordberg as a Diesel Sales Engineer covering the north central territory of Wisconsin, Michigan, Minnesota, North and South Dakota and Wyoming. In his new assignment he will take over the territory formerly covered by the late James Gallaway which includes Missouri, Northern Arkansas, Southern Iowa, Kansas, Nebraska and Colorado.

Automatic Synchronizer for Parallel A.C. Generator Operation

THE Burlington Instrument Company has recently published an interesting bulletin describing the operation of the newly designed Burlington Automatic Synchronizer. In operation the synchronizer acts instantly closing the circuit breaker at the proper time. It eliminates guesswork and requires that generator frequency voltage and phase are correct. The synchronizer is designed for use with generator sets up to 250 kva. rating. Write for Bulletin SN-400, Burlington Instrument Company, Burlington, Iowa.

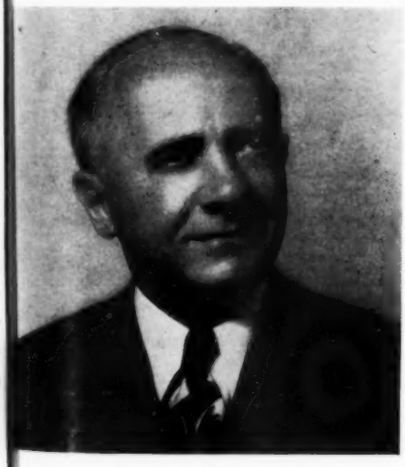
Manzel Doubles Capacity, Changes Name

A MANUFACTURER of lubrication equipment for nearly fifty years, Manzel Brothers Co. has changed its name to Manzel, Inc., and completed an extensive expansion and modernization program.

The floor space of the Manzel plant in Babcock Street has been doubled by an addition completed several months ago. A more recent addition increases office area by 150 per cent. Employment has risen from 98 in 1945 to 251 in September 1947 and is still rising.

Rapid expansion has been made necessary by world-wide postwar demand for Manzel force feed lubricators and chemical feeders; by promotion of Manzel products in several new markets, including hydraulic valves and other mechanisms, and by the recent purchase of the Bowser and Torrington lubricator repair and replacement business from Bowser, Inc., who have discontinued manufacturing this equipment.

Hauck Heads Eastern Sales For Weatherhead



W. L. Hauck

WILLIAM L. HAUCK has been appointed Eastern District Sales Manager of The Weatherhead Company of Cleveland, Ohio, with headquarters at 4302 Lincoln Bldg., 60 East 42nd St., New York City, it was recently announced by H. Church, Vice President in Charge of Sales.

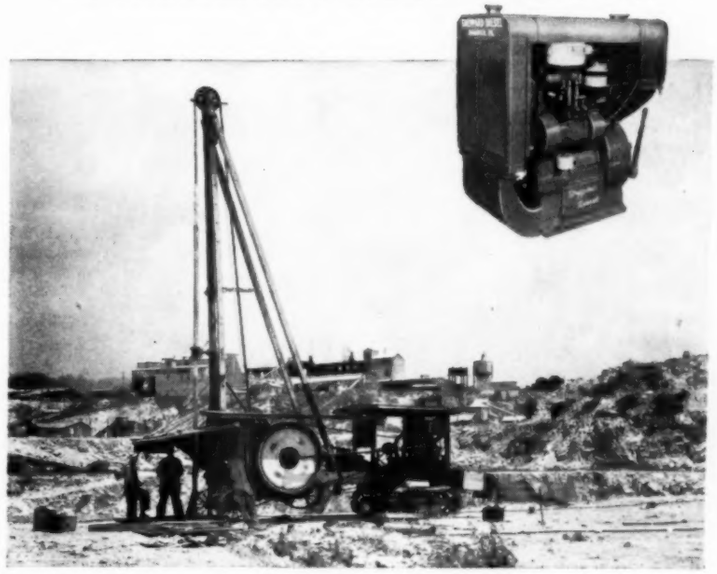
Hauck, a native New Yorker, is well known in the LP Gas Industry. He was formerly sales manager of the Trageser Copper Works, Maspeth, L. I., New York, and District Sales Manager for The Scaife Company in New York.

"Four of a Kind"

. . . a "Blue Chip" Bet

to REDUCE DRILLING COSTS

at Thomasville Stone & Lime Co.



Four 18 H.P. Sheppard Diesels are taking over the job of powering churn drills at Thomasville Stone and Lime . . . replacing four 20 H.P. gasoline engines. As a result of the low-cost, dependable operation of these Sheppard Diesels another order has been placed for a larger Sheppard to be installed in a power shovel.

The Model 13D, Sheppard engines being used in the drills are 2 cylinder full diesels rated at 18 H.P. for continuous operation at 1200 R.P.M.—with plenty of reserve power when the going gets tough.

They are the product of a company which has pioneered in the development of small diesel engines. Their design has been simplified to the greatest degree yet achieved by diesel engineering . . . maintenance and servicing are a simple matter for any average mechanic. They start and operate efficiently on low-cost domestic furnace oil.

It's a better than even bet that you can reduce power costs by switching to Sheppard Diesels. A 3¢ stamp is all it takes to "see." Write for complete specifications—don't forget to state H. P. requirements.

R. H. SHEPPARD COMPANY, INC.
16 Middle St., Hanover, Pa.

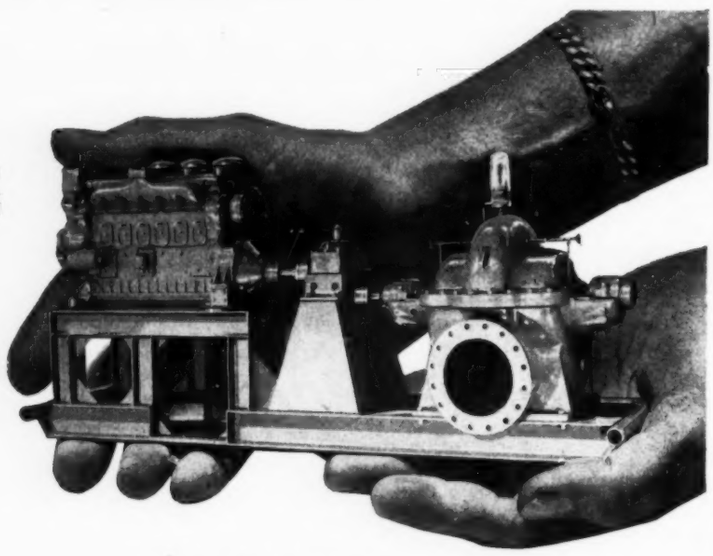
Sheppard DIESEL

DIESEL'S THE POWER . . .
Sheppard's the Diesel

Power Units - 3½ to 62 H.P.—Generating Sets - 2,000 to 36,000 watts

Industrial Storage Battery Introduced by Baker & Co.

A CADMIUM nickel alkaline storage battery which combines advantages of lead acid and nickel iron alkaline batteries was recently introduced to industry by Baker and Company, Inc. Used in Europe for the past twenty years, the cadmium battery has been perfected to fit the needs of a wide variety of industries, including marine, railway communications, food processing, radio and radar, and others. Chief benefit of the battery, the company states, is that it accomplishes alone what was formerly done by a lead acid battery and nickel iron alkaline battery. The Baker battery accepts high or low charge rates with no finish rate limitations, it is pointed out, and has excellent capacities at low electrolyte temperatures with no danger of damage due to freezing. The Baker battery is sturdily constructed of heavy, nickel-plated steel to withstand mechanical abuses. Write Baker & Co., Inc., Newark 5, N. J.



Model 6-71 General Motors Diesel attached to centrifugal pump.

HERE IS *APPLIED* POWER

This centrifugal pumping unit assembly, designed specifically for the Calhoun County Canal Company at Port Lavaca, Texas is one of the many examples illustrating the versatility of Stewart & Stevenson Services . . . complete plant facilities for fabrication of any type of Diesel powered equipment—Pumping Units, Diesel Generator Sets, Switch Gear, and Auxiliary Units. Consult Stewart & Stevenson Services on any of your power problems.

STEWART & STEVENSON SERVICES, INC.

HOUSTON	DALLAS	CORPUS CHRISTI	McALLEN	WICHITA FALLS
4516 Harrisburg Blvd.	4801 Lemmon Ave	643 N. Port Ave	19 East Highway	P. O. Box 1415
Phone W 6-9691	Phone L 6-6649	Phone 8252	Phone 1019	Phone 3319

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General Motors Diesel Engines
Continental Red Seal Gas, Gasoline, Butane Engines
Hallett Diesel Engines

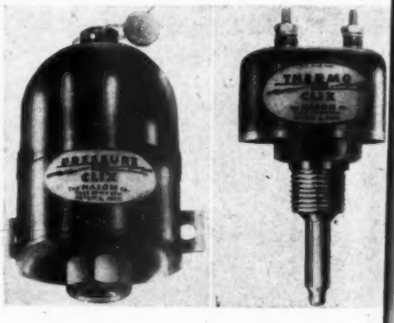
FABRICATORS:
Electric Switch Boards
Electric Generator Sets
Electric Control Equipment

Young Radiator Company Organizes 20-Year Club

THE organization of a 20-Year Club was an nounced by F. M. Young, Founder and Pres dent of the Young Radiator Company, Racin Wisconsin, at their annual picnic held at Lak DeNoon recently. F. M. Young, Founder an President; W. V. Astrup, Chief Engineer an L. C. Pfost, General Superintendent, wer presented with wrist watches in recognition their twenty years of service with the compan

Mr. Young in his remarks stated, "I am deep touched and appreciate very much the privile of accepting this gift, remembering the time started on our own, building our own compan with many who are now here. I am great and deeply indebted to them who came wit me in my new venture, the Young Radiat Company. Without them and without the work, nothing could have been accomplish in the many services rendered by our compan I would rather have 10 men working with m than 100 men working for me."

New Safety Switches



Nason Pressure and Temperature Switches

THE Nason Company of Detroit recently nounced two new safety switches designed the protection of engines against low oil pr sure and overheating. The pressure "Clix" i snap action pressure switch designed for use the transportation field. It is connected in oil pressure line and the alarm sounds wh pressure drops below the safe operating po This unit can also be utilized to warn of lo air brake pressure, even to shut off engine so set up. The temperature switch or "Therm Clix" maintains temperature settings indefini ly. It is actuated by a vacuum filled, bell topped cartridge, completely sealed. It can installed in manifold and will warn of exc sive operating temperatures. The same swi can be used to determine excessive water te peratures. Accessory equipment such as circ breakers and reset switches are also availab Write the Nason Company, 7663 Epwo Boulevard, Detroit 4, Michigan.

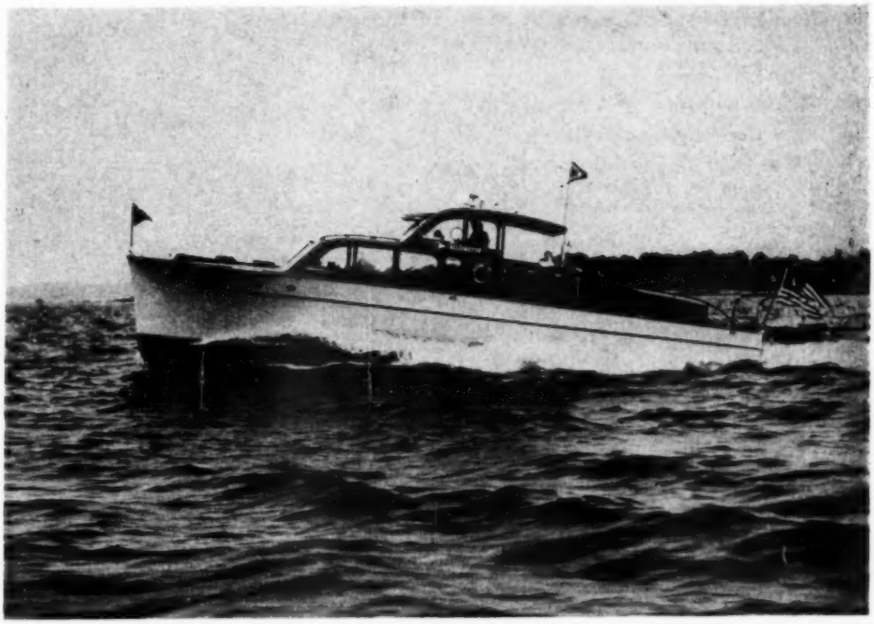
Allis-Chalmers Forms Turbo-Power Department

FORMATION of a new turbo-power development department in the engineering development division of the Allis-Chalmers Manufacturing Co. has been announced by W. C. Johnson, executive vice-president of the company's general machinery division.

R. C. Allen, one of the country's leading turbine engineers and former head of the Allis-Chalmers steam turbine dept., has been named manager and chief engineer of the new department. W. A. Yost, formerly assistant manager, succeeds Allen as manager of the steam turbine department.

Recognition of the growing importance of many current engineering projects in the gas turbine and other turbo-power fields, which have departed from current steam turbine practices, is the basis for creating the new turbo-power development department, according to Johnson. In view of the great amount of research and design involved in gas turbine development, the move can be expected to accelerate progress in these fields where Allis-Chalmers has already taken a leading role, he indicated.

Repowered With Diesels



The 52 foot yacht "Alumette" built by the Consolidated Shipbuilding Company and owned by a prominent New York City business-man has recently been repowered for the third time. On this occasion three 200 HP 6 cylinder General Motors Diesel Series 71 engines were installed to drive the trim vessel's three propellers. Equipped with her new GM Diesel power plant, the "Alumette" turned in a top speed of 19 knots during trial runs and, according to the owner, cruises at 17 knots with ease.

important

DIESEL OFFERINGS

immediate delivery!

HP	MODEL	KVA	RPM	NEW
2—2000	Fairbanks-Morse 33	1875	300	99%
8—1600	General Motors 16-278A	1200	720	95%
1— 840	Fairbanks-Morse M	565	257	99%
2— 450	Fairbanks-Morse 33E	375	360	95%
1— 450	Buckeye Model 80	360	600	New
1— 225	Buckeye Model E	187	400	95%
1— 375	McIntosh Seymour	350	360	85%
1— 365	Ingersoll Rand S	340	600	95%
4— 360	Fairbanks-Morse YVA	300	257	80%
1— 300	Buckeye Model E	250	400	90%
2— 240	Fairbanks Morse YVA	200	257	85%
10— 225	Buckeye Model 80	180	600	New
1— 180	Fairbanks-Morse YVA	150	257	95%

HP	MODEL	KVA	RPM	NEW
3— 165	Murphy ME650	145	1200	95%
2— 150	Buckeye Model E	145	400	95%
5— 100	International UD18	62.5	1200	New
1— 100	General Motors 6-71	75	1200	Unused
1— 350	General Motors 8-268A	250	1200	95%
1— 90	Cummins HIS 600	62.5	1200	New
1— 80	Fairbanks-Morse YVA	65	300	85%
1— 75	Buckeye Model J	62.5	600	95%
4— 65	International UD14	37.5	1200	New
1— 60	Buckeye Model J	50	600	95%
1— 40	Buckeye Model J	30	600	95%
3— 35	International UD6	18.7	1200	New

Diesel Motors

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ENGINEERING SOCIETIES MEETINGS SCHEDULED

A.S.M.E. 1947 Meetings

Petroleum Mechanical Engineering		
1947 Conference	Houston	October 6-8
Fuel and Coal Division		
10th Joint Conference	Cincinnati	October 20-22
Annual Meeting	Atlantic City	December 1-5

S.A.E. National Meetings

Aeronautic		
Fall Meeting & Aircraft Engine Display	Los Angeles	October 2-4
Production Meeting	Cleveland	October 20-21
Fuels and Lubricants	Tulsa	November 6-7
Air Transport Engineering	Kansas City	December 1-3
Annual Meeting and Engineering Display	Detroit	January 12-16

Fawick Airflex Clutch Bulletin

A BEAUTIFULLY designed, four-color bulletin has been recently issued by the Fawick Airflex Company, Inc., which tells the story of the Airflex Clutch. Engineering information, specifications, ratings, and service factors are included to make the bulletin very comprehensive. Write Fawick Airflex Co., Inc., 9919 Clinton Road, Cleveland 11, Ohio. Ask for Bulletin 300.

Sperry Radar Catalog

A NEW section of their master marine sal catalog devoted to marine radar has recent been published by the Sperry Gyroscope Co pany, Inc. The section, singly identified "Publication 23-220," not only describes t operation of the equipment and outlines i specifications but also describes its three rol as pilotage aid, position-indicator and an collision aid. The catalog is generously illu trated with photos, sketches and diagrams black-and-white and color. It is available request, write Sperry Gyroscope Company, In Great Neck, New York.

Earthmoving Described

CATERPILLAR Tractor Co. shows what equipment, and auxiliary units, can do in b and small earthmoving operations in a ne 16-page booklet, *Earthmoving Calls for "Cate pillar."* The booklet points to proper applic tions of Diesel equipment and power for dam airport and housing construction, road build ing and maintenance, mine stripping, loggin operations, railroad work, crushing and grave plant and farming duties.

Copies of the publication may be obtained b writing the manufacturer, Peoria 8, Ill., r questing Form 10361.

BURGESS SNUBBERS · BURGESS SNUBBERS
How to be sure
of a quiet exhaust
There is no substitute for good exhaust system control if you are to have a quiet exhaust free of noise complaints.
To be sure of a quiet exhaust, use a Burgess Exhaust Snubber. It provides the freedom from noise required by every engine operating near workers or residences. The exclusive Burgess snubbing principle provides complete noise control, preventing noise before it occurs. Explosive "slugs" of exhaust gas are sent smoothly into the atmosphere, their energies dissipated within the multi-chambered Snubber.
Burgess Snubbers are available for every size and type of Diesel engine. Write today for detailed information.
BURGESS-MANNING COMPANY
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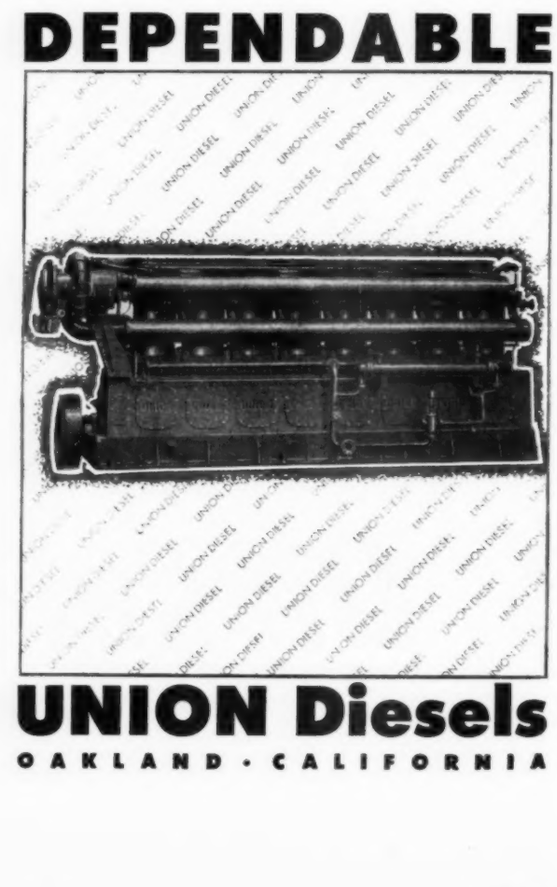
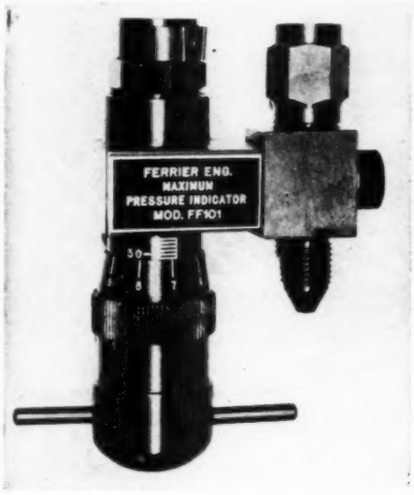
BURGESS SNUBBERS · BURGESS SNUBBERS



Standardized Fuel Injection Test Equipment



Ferrier Maximum Pressure Indicator

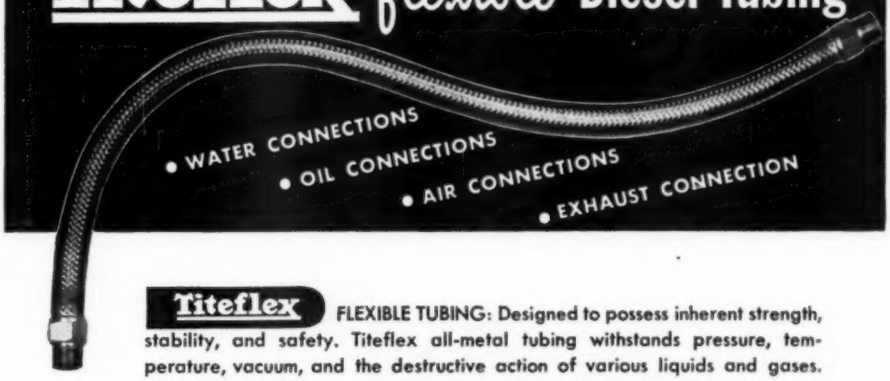
FERRIER Engineering has recently introduced a line of fuel injection test equipment to the Diesel industry. The new line includes pressure indicators, pump calibrating and governor regulating test stands, spray test apparatus, together with accessory equipment and service tools. This testing equipment was made previously for the sole use of injection equipment manufacturers but now with the increasing need for this type of equipment in the field Ferrier Engineering is now marketing a complete line. One of the most interesting machines offered is the apparatus for determining the actual rate at which fuel is injected into the combustion chamber during each degree of the injection process. For further information on this and other equipment write Ferrier Engineering, 185 Breckwood Boulevard, Springfield, Mass.

Complete Line of Bearings Described in New Bunting Catalog

THE Bunting Brass and Bronze Company has recently issued a new catalog describing in detail its many products including standard stock bearings, bronze bars, and electric motor bearings. All bearings are listed according to size and part number affording an easy reference guide to catalog users. The section devoted to electric motor bearings catalogs all bearings according to motor manufacturer's part number, which is cross indexed to Bunting part number. The catalog concludes with a short resume of sleeve bearing theory.

Write the Bunting Brass and Bronze Company, 715-755 Spencer St., Toledo 9, Ohio for Catalog No. 46.

Titeflex *flexible* Diesel Tubing



Titeflex FLEXIBLE TUBING: Designed to possess inherent strength, stability, and safety. Titeflex all-metal tubing withstands pressure, temperature, vacuum, and the destructive action of various liquids and gases. Construction is of brass, monel, stainless steel, and various other metals.

Titeflex BENDABLE PIPE: Constructed of all-metal with fully interlocked joints, Titeflex bendable pipe is easily and effectively installed, absorbing destructive vibration and sway, and is inherently tight for carrying exhaust gases.

Titeflex, Inc. 524 Frelinghuysen Ave., Newark 5, N. J.

Exclusive Manufacturers of Titeflex high quality products for more than 30 years

Sales Offices { CHICAGO CLEVELAND DETROIT PHILADELPHIA LOS ANGELES BOSTON SAN FRANCISCO TORONTO

RITCO

LOCOMOTIVE FASTENERS

STRONG • ACCURATE • DEPENDABLE

RITCO Diesel locomotive bolts and studs are made for heavy duty service. Bolt heads are accurately forged, threads precision cut or rolled . . . every RITCO fastener is uniform in strength and fully dependable. Made in any metal, ground or unground, bolts to 2" diameter, nuts to 3" — exactly to your blueprint.

Remember RITCO For
Special Bolts, Nuts and Studs • Alloy Steel Studs
Milled Body Bolts • Drop Forging • Heat Treating
Diesel Engine Bolts and Studs

Let us quote on your specifications

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PROVIDENCE 1, RHODE ISLAND

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WHETHER YOU BUILD OR OPERATE

Automotive Diesels

IT WILL PAY YOU TO USE

SEALED POWER SLEEVES

SEALED POWER PISTONS

SEALED POWER PISTON RINGS

SEALED POWER CORPORATION
MUSKEGON, MICHIGAN
IN CANADA: STRATFORD, ONTARIO

FOR ORIGINAL EQUIPMENT...

Leading Diesel engine builders in truck, tractor and equipment fields have long preferred Sealed Power products.

FOR REPLACEMENT...

Sealed Power motor parts for Diesel engine needs are supplied by leading distributors throughout America.

SEALED POWER LEADS THE FIELD!

Whether you build or operate automotive Diesels, Sealed Power offers you the full resources of the industry's finest laboratories, technical staff, and manufacturing facilities.

SEALED POWER PISTON RINGS

PISTONS • CYLINDER SLEEVES

Power

PROTECTED BY PUROLATOR

Diesel pressure mechanisms must be kept free of grit and grime to prevent any needless wear of injector plungers . . . or clogging of injector tip orifices. That's the direct way of fighting off lost power. Purolator filters provide the protection so vital for sustaining power output.

Purolator Products, Inc., Newark 2, N. J.

In Canada: Purolator Products (Can.) Ltd., Windsor, Ont.

Eightieth Anniversary of the Foundation of R. A. Lister Co. Ltd.

AUGUST 23, 1947, marked the 80th anniversary of the foundation of the leading British Diesel Engine Manufacturing firm of R. A. Lister & Co., Ltd., of Dursley, Gloucestershire, England.

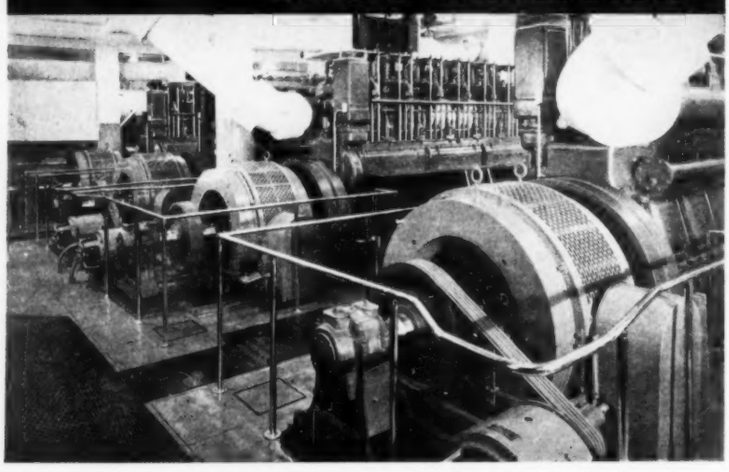
During forty of these eighty years, R. A. Lister & Co., Ltd., have been selling their engines in the United States, the first Lister engines having been sold here in 1907.

Taking part in the August 23rd celebration was the famous "Golden Arrow" mobile Lister-powered Radio Unit, which was used by Field Marshal Montgomery throughout his campaigns from Alamein to the Baltic. This famous unit was designed by the British Royal Corps of Signals. It was equipped with the latest ultra high-frequency transmission equipment and was proof against enemy listening-in, being operated on the same basis as the system now being installed by the Bell Telephone Company between New York and Boston ("Seven Towers on Seven Hills").

On August 23rd, the "Golden Arrow" unit was stationed in London, where it received congratulatory messages from all Lister's subsidiaries and agents in over 30 different countries, and relayed these direct to Dursley in Gloucestershire, two hundred miles away.

R. A. Lister & Co., Ltd., and their associates Blackstone & Co., Ltd., are represented in the U. S. by Lister-Blackstone, Inc., who manufacture the Lister CD (8 hp.) and CE (16 hp.) Diesel engines in Milwaukee, Wis.

KORFUND CONTROLS DIESEL VIBRATION



The Diesels in this typical installation are mounted on concrete foundations and isolated with Korfund Steel Spring Vibro-Isolators.

Here are a few of the hundreds of installations successfully isolated by Korfund Vibration Control:

Lenox Hill Hospital, New York	1	750-hp. Worthington
2 Park Avenue, New York	4	450-hp.; 1 750-hp. Worthington
New Yorker Hotel, New York	1	530-hp.; 1 750-hp. Busch-Sulzer
Namm Department Store, Brooklyn	4	300-hp.; 1 180-hp.; 1 150-hp. Worthington
Macy's, New York	1	700-hp. Alco
Floyd Bennett Field, New York	1	450-hp. Fairbanks-Morse
Prudential Insurance Co., Newark, N. J.	1	740-hp. Baldwin
Lone Star Gas Co., Dallas, Texas	1	400-hp. Cooper-Bessemer (Gas)
Sun Oil Co., Marcus Hook, Pa.	4	250-hp. Ingersoll-Rand (Gas)
Cia Central Argentina De Electricidad Buenos Aires, S. A.	1	270-hp. Sulzer; 2 540-hp; 1 540-hp.; 1 700-hp. Deutz

If you have a vibration problem, call on Korfund, without obligation. Our engineers will analyze your problem, and recommend the correct vibration control equipment.

KORFUND VIBRATION CONTROL

THE KORFUND CO., INC.
48-28 32nd Place
Long Island City 1, N. Y.

Burlington Instrument Company Announces New Representatives

THE Burlington Instrument Company recently announced the appointment of the Balch Sales Company of Minneapolis and Woodman, Rayfield & Potter Co., of Atlanta, Georgia, as representatives authorized to handle Burlington electrical equipment in their respective areas. These concerns will stock the Burlington line of electrical indicating instruments, generator voltage regulators, automatic synchronizers and other equipment.

Booklet Describes Westinghouse Rototrol

WHAT Rototrol is, what it does, and how it works, is outlined in a new 36-page booklet on automatic operation for electrical equipment announced by the Westinghouse Electric Corporation.

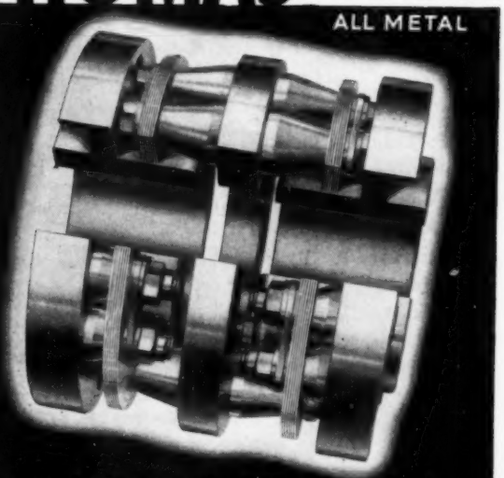
The booklet explains how Rototrol regulates voltage, speed, current, power, speed and torque, power-factor, and position, and provides stability control and current limiting. Photographs, schematic diagrams and performance curves are used to describe Rototrol applications in the automotive and aviation, central station, construction, machine tool, marine, metal-working, mining, paper, rubber, textile and other industries.

Seven pages of technical information are also included giving additional data on the theory, design and operating principles of standard Rototrols and several frequently used modifications.

Copies of the booklet (B-3649) may be secured from the Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

THOMAS *Flexible* COUPLINGS

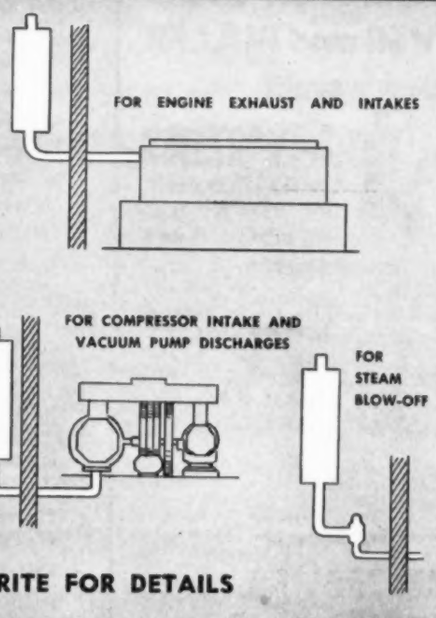
ALL METAL



provide for Angular and Parallel Misalignment as well as Free End Float...
BACKLASH, FRICTION, WEAR and CROSS PULL ARE ELIMINATED
NO LUBRICATION IS REQUIRED!

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

MAXIM SILENCERS



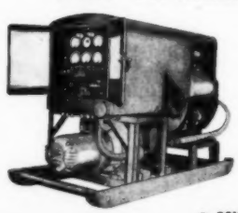
WRITE FOR DETAILS

THE MAXIM SILENCER COMPANY
94 HOMESTEAD AVE., HARTFORD 1, CONN.

NOW! the POWER UNITS with the THREE WAY ECONOMY

4 KW OIL ENGINE GENERATOR

NEW! For immediate delivery!



- 4 KW
- 3 PHASE
- 60/50 CYCLES
- 120 VOLTS
- 1800 R.P.M.
- 1200 LBS. NET WT.

• 70" Long, 58" High, 35" Wide

1. *save on* . . . FUEL— using regular inexpensive fuel oil.
2. *save on* . . . COST— units are war surplus priced for quick sale.
3. *save on* . . . SPACE— engine and generator are in one compact unit with self-contained control panel.

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"FIXED-READING" PREMAX

MODEL YRF
ENGINE PRESSURE INDICATOR
for DIRECT-READING OF COMPRESSION AND FIRING PRESSURES
OF EVERY TYPE OF DIESEL ENGINE

ONE OF THE FEATURES Responsible for Its Overwhelming Preference by Leading Diesel Manufacturers and Operators

No mistake can be made in reading—since only one figure appears in the window of the counter—and this figure represents the actual engine pressure directly in pounds per square inch.

For other features, write for Bulletin 294

ACCURATE PRESSURE READINGS as high as 1700 P.S.I.

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TITAN-KIRKLAND Combination STUD DRIVER and PULLER

- Incorporates ROLL ACTION to GRIP as little as ½" of unthreaded body of stud.
- Requires only a slight left or right hand turn to *GRIP* stud.
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Made in T-Handle, Ratchet, and Power styles in standard sizes from 3/16" to 1" inclusive. Larger sizes on request.

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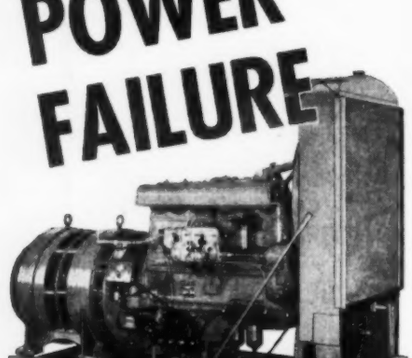

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"U. S." builds a complete line of Diesel and Gasoline-powered Electric Plants... ½KW to 125 KW — A. C. and D. C.
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OSHKOSH, WISCONSIN

Marine Remote Controls

AN attractive 12 page bulletin recently published by the Adel Precision Products Corporation illustrates and describes the operation of the ISOdraulic Remote Controls manufactured by that concern. These controls as described provide an easy means of operating marine craft from any desired location aboard ship. Movement of the master control handle applies pressure to a fluid, contained in a closed circuit of tubing, which pressure actuates the slave unit which in turn operates the engine throttle or governor control. These controls are available as manual or power operated units. The bulletin describes fully the selection of the proper control for a variety of installations for both types of controls, power and hand operated, with graphs and selection charts. Write Adel Precision Products Corp., Burbank, California, for your copy.

Barrow Named by Sperry Gyroscope as Chief Engineer

DR. W. L. Barrow has recently been appointed chief engineer of the Sperry Gyroscope Company, Inc., it was announced recently by C. A. Frische, vice president for engineering.

Dr. Barrow joined Sperry in 1943 as full-time director of armament engineering following several years of serving as consultant. Previously on the staff of the electrical engineering department at Massachusetts Institute of Technology, he is widely known in military, naval and scientific circles and particularly for his early contributions to microwave communications, electronics and radar.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised—more complete—indispensable. Convenient order coupon on Page 100 this issue. Mail it today.

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Highest Quality Gaskets & Oil Seals
by **FITZGERALD**
Gasket Craftsmen for 41 Years

Gaskets of all types and materials to give reliable service under all Diesel operating conditions.

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TORRINGTON, CONN.
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THE COMPLETE LINE THAT COMPLETELY SATISFIES

BAILEY GRADUATES GET THE JOBS!

"...found Bailey Diesel School Graduates Best of All!"

THOMAS RAGSDALE
Chief Engineer Ohio Co.

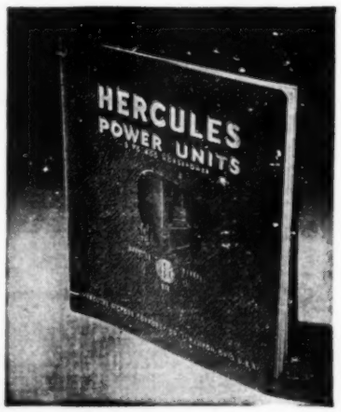
"Technical training plus shop experience offer 3 important advantages" *says Ohio River Company Chief Engineer.*

This is another big user of Diesels who is enthusiastic about Bailey Graduates, saying these Diesel men are better in (1) ability to find troubles before too late. (2) do fine precision work, and (3) become permanent employees who advance rapidly.

When you need young men who can grow with your business, let us know.

The BAILEY Diesel Schools
1651 S. Grand Ave., St. Louis 4, Mo.
Modern Training by Shop Practice
DIESEL RADIO ELECTRICITY
REFRIGERATION and AIR CONDITIONING

Hercules Publishes New Power Unit Catalog



HERCULES Motors Corporation has just published a new Power Unit Catalog. This catalog, superseding as it does the one published prior to the war, gives to power users an up-to-date knowledge of the complete line of Hercules gasoline and Diesel engines and power units now available in a wide range of from 3 to 400 horsepower. Hercules gasoline engines are being offered in 13 series and 27 models in 2, 4 and 6 cylinder sizes. These engines can be furnished for operation on gasoline, natural gas, kerosene, or butane fuel. Hercules Diesel engines are built in 9 series and 22 models in 2, 4, 6 and 8 cylinder sizes.

In addition to listing and describing in detail Hercules engines and power units, pertinent information is given throughout the book to assist the power user in choosing the most suitable power for his particular application with a section devoted to accessories, power take-offs and reduction gears that will prove invaluable.

Retail stores are maintained by Hercules Motors Corporation at Los Angeles, Calif.; Salem, Ill.; Tulsa, Okla.; Houston and Kilgore, Texas, and distributors in most principal cities. Write for your copy of the Hercules Power Unit Catalog from the Hercules Motors Corporation, Canton, Ohio.

Caterpillar Booklet Available

AN 8-page booklet published by Caterpillar Tractor Co., Peoria 8, Illinois depicts the part played by "Caterpillar" Diesels in garbage and sewage disposal, water supply and purification strides, and disease-carrying pest extermination. Copies of the illustrated booklet may be obtained by writing the manufacturer, Peoria 8, Ill., requesting Form 10362.

"MANZY" the MAINTENANCE MAN
KEEPS POWER EQUIPMENT RIGHT

He's a faithful little fellow who's always in there pitching... seeing that engines, compressors and other heavy equipment receive just the right amount of oil, when and where they need it most. 46 of his many brothers were put to work on this Clark "Big Angle" Compressor because the purchaser wanted long, trouble-free, economical operation.

You too can insure money-saving efficiency by installing Manzel Force Feed Lubricators on present or future equipment. Write for information or advice on any of your problems.

Builders of HIGH PRESSURE METERING PUMPS Since 1898

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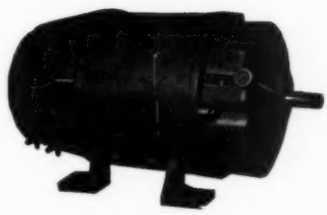
GENERATORS AC and DC



Well-known for their rugged design, efficient performance, long life and minimum maintenance, whether powered by electric, gasoline, or Diesel equipment. Backed by over ½ century of manufacturing and designing experience, Kurz and Root generators are now serving industries throughout the world

DC generator (left) two - bearings, self excited type Can also be furnished with direct connected exciter. Both AC and DC generators can be furnished in the single bearing, flange-mounted type for special mounting requirements. Ball bearing construction is used throughout. Complete data upon request.

Illustrated are AC generators, only 2 of the many different types developed and designed to fit specific needs and applications, (upper left) two-bearing self-excited type; (lower right) two-bearing direct connected exciter type.

K-R GENERATORS

KURZ-ROOT Company Since 1898

APPLETON - WISCONSIN

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DIESEL FUEL
INJECTION SERVICE

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Factory Trained Specialists

DIESEL DURHAM SERVICE

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Our Service Equipment has been designed and built under the supervision of factory service engineers.

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RELIANCE
Quality
TACHOMETERS

Reliance Tachometers are the standard wherever accurate, dependable measurement of engine speed is desired.

For complete information send for Catalog D

BARBOUR STOCKWELL COMPANY
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Twin Disc Clutch Company Cited In Management Poll

THE Twin Disc Clutch Company was recently nominated one of the best managed companies in the United States. It was one of 209 firms chosen by business men as being outstanding in the nation.

Porter Names Pacific Coast Sales Manager

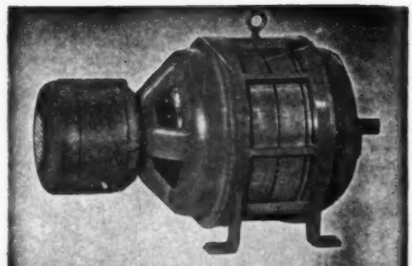
IN view of the steady advancement of Porter sales on the Pacific coast and in keeping with their proposed expansion program, H. K. Porter Company, Inc., announced recently the promotion of Harold A. Hintz to Pacific Coast Sales Manager. Mr. Hintz will direct the activities of all Porter sales offices on the Pacific Coast and will maintain headquarters in the Petroleum Building, Los Angeles.

At the same time Mr. Calihan, Director of Sales, announced the appointment of J. F. Morley, as District Sales Engineer, with offices in Monadnock Building, 681 Market Street, San Francisco 5, California.

On Their Way

First motors to be manufactured in the new Ashtabula (Ohio) plant of the Reliance Electric & Engineering Company were packed for shipment under the personal direction of company executives.

The new plant will be used for the production of 1 to 15 horsepower electric motors and V*S drives, the latter a prewar development of Reliance which has found increasingly wide application in all major wide industries. Output of motors will be on a small scale for a time, it was announced, with full production from two shifts to be reached within 90 days.



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D.C. UNITS range from 7½ to 200 KW.
A.C. UNITS range from 6¼ to 300 KVA.
Speeds and other specifications to meet requirements. Write for full information.

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GENERATORS
A.C. and D.C.

Forged Steel Design made to special order for all types and sizes of air and gas compressors—from 2" to 16" diameter.

Valve plates and discs of all designs in alloy steel, stainless steel, monel, bronze and other metals.

Write for estimates and send samples or blueprints of your old valves.

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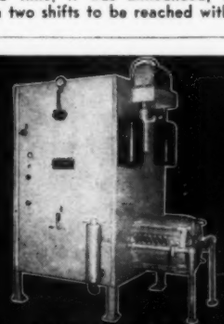
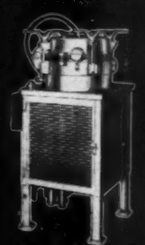

AIRLINE OIL PURIFIER

HYFLOW OIL FILTER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THERE'S A HILCO FOR EVERY LUBRICATING, FUEL AND INDUSTRIAL OIL PURIFYING PROBLEM

THE HILLIARD CORPORATION, 122 W. FOURTH ST., ELMIRA, N. Y.

Dennison Discusses *Cont. from p. 74*

blower discharge pressure. The scavenging differential pressure will then increase as will the work returned on the suction stroke. Both are beneficial effects. From the point of inlet valve closing, the cooling of the charge is equal to the adiabatic temperature drop.

Supercharging to 18 psi. gauge without intercooling does not increase engine ratings in the ratio of 2 to 1 as predicted by Mr. Dennison. I have shown above that on the basis of equal temperature conditions, an engine rated 120 MIP non-supercharged can be rated only 156 MIP when supercharged to 18 psi. gauge—only 30% increase. This is no more than is now obtained with the Buchi System at 4 psi. And to make matters worse, the engine would operate with combustion pressures in the neighborhood of 1500 psi.

We have two ways of increasing the weight of the air charge: First, by increasing the pressure at beginning of compression (no change in temperature T_1). Formula 1 in the paper shows that this increases the MIP directly as the pressure with identical temperatures throughout the entire cycle. Second, by decreasing the temperature at beginning of compression (no change in pressure P_1). The weight of air increases inversely with the absolute temperature T_1.

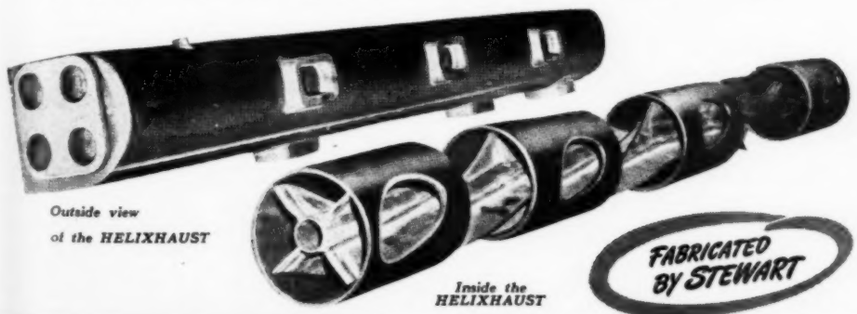
If we now increase the fuel burned only in the ratio of the increase of weight of the charge, we will find that we do not reach the same cycle mean temperature because, while the air-fuel ratio and, therefore, the temperature rise, is the same, combustion starts at a lower temperature. More fuel can, therefore, be burned and the air-fuel ratio decreases with constant- cycle- mean- temperature- with- decreasing initial compression temperature T_1.

This is readily seen in Figure III. Assume an engine operating at 100 MIP non-supercharged with a $T_1 = 680°$ R. The ratio T_m/T_1 is then 1.86 and $T_m = 1.86 \times 680 = 1265°$ R. Decreasing T_1 to 620 increases T_m/T_1 to 2.04 and this reads 123 MIP on the zero gauge pressure line. The load has been increased 23% for equal cycle mean temperature, but the weight of air has been increased only in the ratio of 680/670 or 10%.

I wish to thank Mr. Dennison for his discussion and the opportunity to clarify these points.

THE... HELIXHAUST WATER-COOLED MANIFOLD

The HELIXHAUST reduces temperature of exhaust gasses—makes engine room more livable. It increases permissible supercharged rating of Diesel engines. It's simple, yet highly efficient, neater and more attractive when mounted on the engine. *It modernizes 4-cycle Diesels by turbo-charging.* Write for literature containing complete specifications on the HELIXHAUST and details on Intake Manifolds, Water Inlet Headers and Water Discharge Pipes. Stewart engineers will be glad to talk over with you further the advantages of the HELIXHAUST Water-Cooled Manifold.



Outside view of the HELIXHAUST

Inside the HELIXHAUST

FABRICATED BY STEWART

Stewart FABRICATORS OF IRON · STEEL · WIRE

THE STEWART IRON WORKS CO., Inc.
1481 Stewart Block
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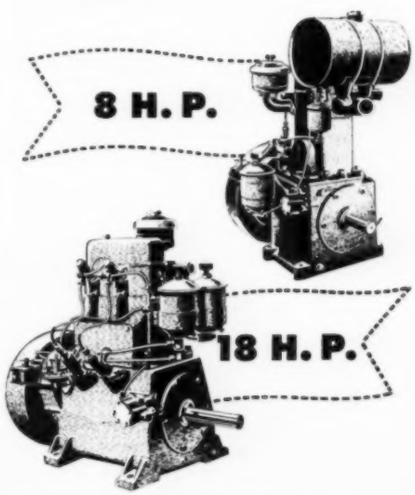
DIESEL POWER YOUR SIZE



Hallett brings Diesel efficiency, economy and dependability to the 8 and 18 horsepower range, with 1 and 2 cylinder models, for primary or auxiliary, industrial, marine or farm uses.

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2. Heavy duty Timken bearings on crankshafts do away with outboard bearings — permit heavy load on the side drive.
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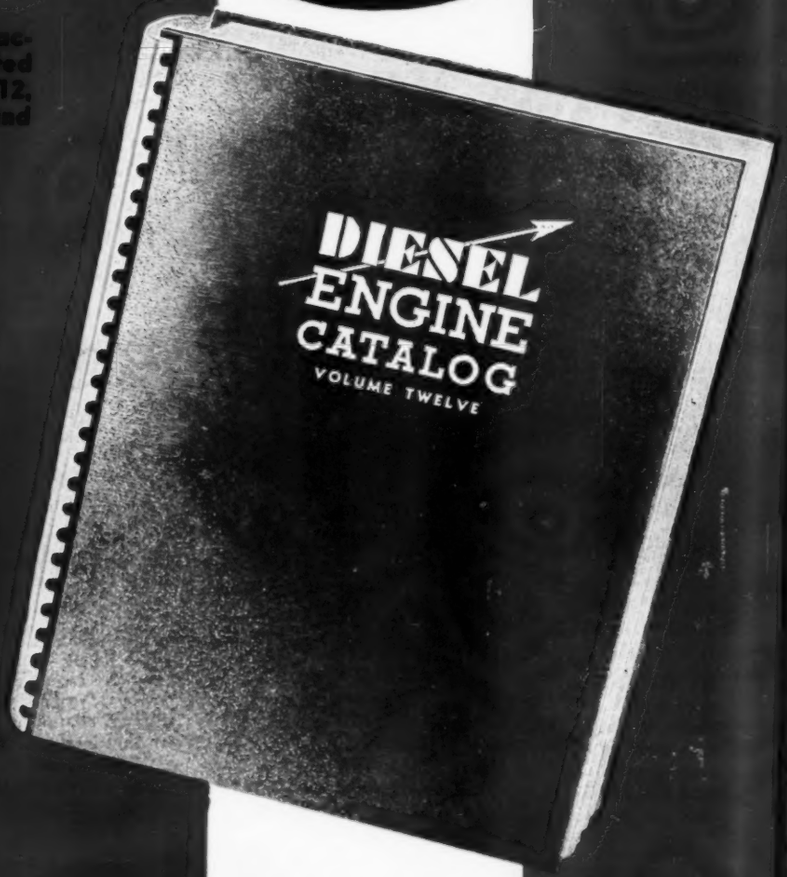

THE WHOLE DIESEL INDUSTRY UNDER ONE COVER

Wherever you are looking for in Diesel engines, or accessories, you will find them described and illustrated in the 1947 DIESEL ENGINE CATALOG, Volume 12, edited by Rex W. Wadman. What's more, you will find complete specifications on

822 DIFFERENT MODELS

The Products of 53 Engine Manufacturers. Each engine description is complete and accurate—checked and double-checked by the Manufacturer himself. Illustrations include full-page engine views, lube and fuel system diagrams, also cooling systems—many traced in color.

But that is just the Diesel engine section. The Catalog also includes an accessory section carrying valuable information on the various Fuel Injection Systems, Gear and Chain Drives, Turbochargers, Blowers, Magnetic Couplings, all fully described and profusely illustrated.

FOR DESIGN AND OPERATING ENGINEERS AND BUYERS

There is a Market Place Section—a directory of Diesel engines classified as to ratings and speeds with manufacturers' names and addresses—and a Product Directory including accessories, parts, materials and services—all classified as to products. The Market Place tells you at a glance where to find what you want for your engine or plant.

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Over 500 Pages - Really 4 Books In One

1. The main section is devoted to descriptions, illustrations and specifications of all the Diesel engines manufactured in this country.
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4. Manufacturers' Advertisements—informative—helpful.

REVISED ANNUALLY

The most comprehensive Diesel reference book published—because the book is revised and brought up to the minute each year, thousands of design and operating engineers, purchasing and sales executives, Diesel students and the DIESEL ENGINE CATALOG each year are increasingly refer to it throughout the year. The 1947 CATALOG, Volume 12, embodies sweeping changes — new engines and types, revised designs, and carries the basic information published in previous editions. Whatever your interest in Diesels is you will find this Edition of the DIESEL ENGINE CATALOG indispensable.

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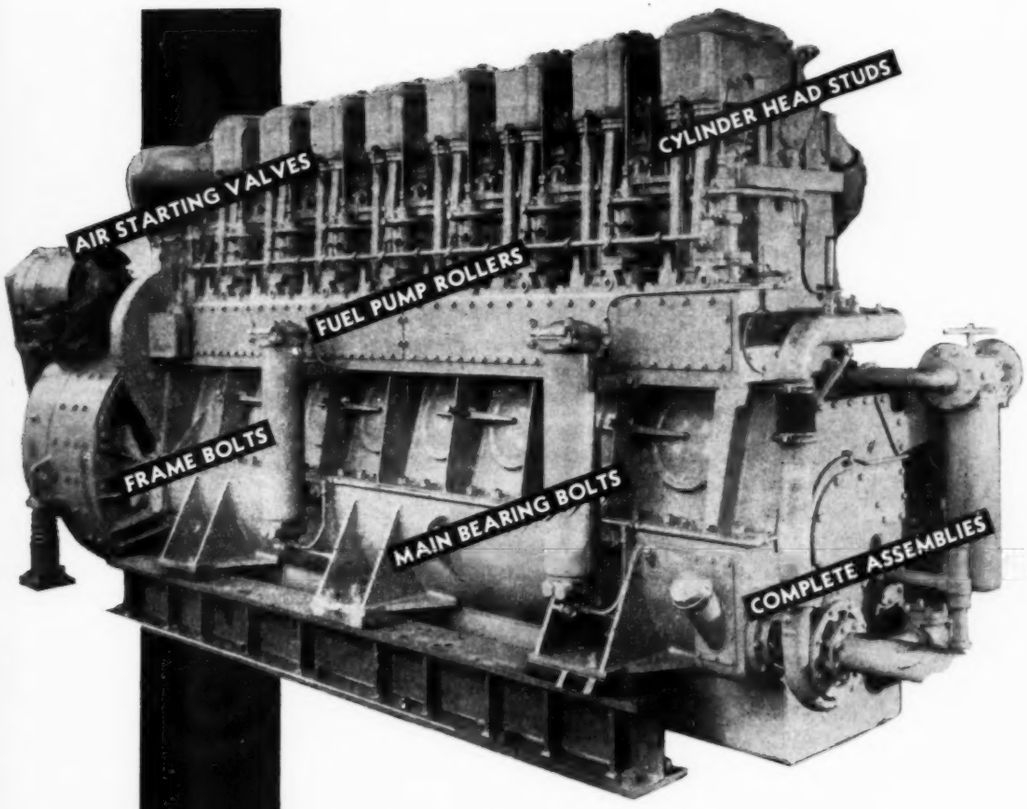

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are Diesel Engines designed to incorporate precision made parts.

BECAUSE parts must have uniform tensile properties and uniform dimensions in order that the engine may produce constant rated power under full load, at progressively lower cost, and assure economical assembly plus easy and simple replacement in the field.

WHY should you use A.P.P. precision made Diesel parts and assemblies?

BECAUSE A.P.P. over many years has successfully produced precision parts for the Aviation, Automotive and Diesel Engine Industries. Our long experience has taught us to accept the axiom.

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Mr. Manufacturer, you know it costs more time and money to reject a part than to accept it. A.P.P. INSPECTION assures a full acceptance of its products.

THE FOREGOING STATEMENT IS BORNE OF A LONG SERVICE WITH PRESENT USERS.

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Connecting rod bolts — Connecting rod nuts — Main bearing bolts — Frame bolts — Crosshead guides — Wrist Pins — Precision Shafting — Rocker Arm Shafts — Fuel pump and push rod rollers and pins (Case hardened or Nitralloy finish) — Fuel pump and push rod roller guides — Air starting valves — Tappets — Automatic machine products, etc.

WRITE FOR QUOTATION ON YOUR SPECIFICATIONS

APP

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LUBRICATORS
A modern lubricator for modern service on Diesel, gas, steam engines and compressors. Supplies dependable cylinder lubrication in metered quantities reducing friction and wear. Capacities: 2 to 24 pt. and 1 to 16 feeds. New catalog on request.
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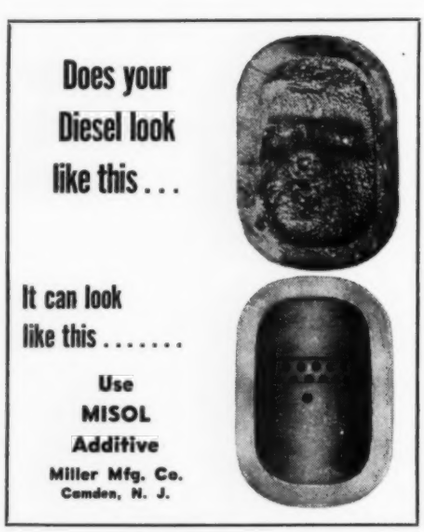

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GLOBE AMERICAN CORP.
Macomb, Illinois

West Coast Diesel News

By FRED M. BURT

THE *Ruthie B*, 110 ft. long, built for Wm. H. Black of La Jolla, by National Iron Works, is the largest steel clipper ever built in San Diego Harbor. Her fuel capacity of 27,491 gal. provides a cruising range of 10,500 miles; main engine an Atlas 6 cyl. Imperial Diesel, four-stroke cycle, 13 in. x 16 in., 315 rpm., supercharged; auxiliaries, two Atlas 6 cyl. Imperial Diesels, 600 rpm., 112 bhp.

FOR operation on a passenger run on the West Coast of Vancouver Island, former Fairmile sub-chaser, *Machigonne* has been converted by Gibson Bros., Ltd., to a single propeller drive, using a 500 hp. G.M. Diesel, from the former, twin-screw gasoline engine drive.

THE 97 ft. *Aquitania*, one of the largest seiners in the Pacific fleet, has just been converted from a surplus tug, by Capt. Marco Legaz, built by Western Boat Bldg. Co., Tacoma. She is powered with a 450 hp. Fairbanks-Morse Diesel wtih a 45 hp. F-M auxiliary driving a 25 kw. F-M generator.

POWERED with a 1050 hp. Enterprise Diesel; auxiliaries a pair of 230 hp. Atlas Imperials, is the 135 ft. *Santa Helena*, a new steel purse seiner at Avondale Marine Ways, New Orleans, following the series of steel tuna clippers built for West Coast fishing. This vessel is for Capt. Andrew Zamberlin in association with Van Camp Sea Food Co.

THE newest of the "Maid" series, is Harold Hanson Boat Company's (Seattle) *Dixie Maid*, 56 ft. x 16 ft., and powered with a 115 hp. "Caterpillar" Diesel. She joins *Valiant Maid* and *Famous Maid* in the Hanson-built and Hanson-owned fleet.

POWERED with an 840 hp. Superior Diesel, 132 ft. x 30 ft. x 14½ ft. steel tuna clipper, *Sun Jason* is the last of four designed by G. Bruce Newby, Long Beach, and built by Avondale Marine Ways, New Orleans, for fishing out of San Diego off the West Coast of South America. Auxiliary is a Chicago Pneumatic, 187 hp. 6 cyl. mechanical injection Diesel engine.

WANTED

First class designer and layout man. Experience on Gas-Diesel desirable. Must be capable of making fast and accurate layouts. Only men with at least 10 years experience in design of medium-speed Diesel engines need apply. Write giving full data and background in first letter. Address: Box 174, DIESEL PROGRESS, 2 W. 45th St., New York 19.

The Experience Resulting from 85 Years Devoted Exclusively to the Design and Application of Both Plain Mechanical and Hydraulic Types of Governors Is Available When You

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WITTE Full Diesel Units Are 100% Factory-Tested for Power and Low-Cost Performance . . .

This is no superficial check-up, but a regular phase of WITTE mass production, positive and exacting. Through the years it has helped to build the world-wide WITTE reputation for dependability. No WITTE Diesel unit receives its name-plate and serial number until it meets all factory tests.

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Start and Operate on Non-explosive Diesel Fuel

Full Diesels, WITTE Diesel Engines and WITTE Dieselectric Plants produce no poisonous exhaust — built to occupy little room they are safe for operation even in confined places. There's a size and type to meet your needs. Write for descriptive literature — or see your WITTE DEALER.

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One 80 HP, twin cylinder Diesel engine made by Fairbanks, Morse & Co. Includes air tanks and water pump. Excellent condition.

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Design Engineer or Draftsman familiar with Diesel and dual fuel engines. Address: Box 173, DIESEL PROGRESS, 2 W. 45th St., New York 19.

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NORWEGIAN motorship, *Bataan*, Fred Olsen Line, on her maiden voyage this summer, came direct from Oslo to Panama, to San Pedro & Seattle. The twin-screw ship is said to be the largest vessel ever built in a Norwegian yard; 507 ft. long x 63 ft. x 27 ft. draft, deadweight tonnage 9500, built by Aker's Mek, Verstad, who also built the ship's twin, 9 cyl., 2 cycle, Diesel engines, 24.4 in. x 45 in., combined rating of 10,800 ihp. at 123 rpm., under Burmeister and Wain license; auxiliaries are four Burmeister & Wain, 5 cyl. Diesels, driving 166 kw. generators.

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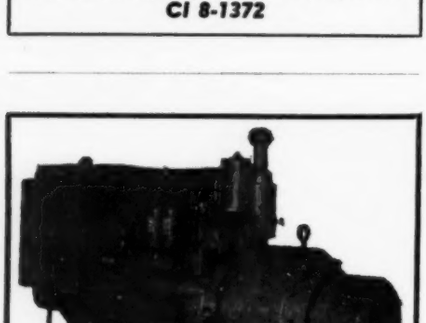

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